

Marine Engineering

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Fig. 1.—Munson Liner *Aeolus*

Steamship *Aeolus* Re-Conditioned

Former German Liner, Recently Used as War Transport, Re-modelled for South American Passenger and Freight Service

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MARKING the completion by The Baltimore Dry Docks & Ship Building Company, Baltimore, Md., of one of the most extensive ship repair contracts ever awarded in the history of the United States, with an expenditure of nearly three million dollars involved, the steamship *Aeolus*, formerly the North German Lloyd liner *Grosser Kurfurst*, left Baltimore on November 20 on her way to New York, where she was delivered to the Munson Steamship Company for operation in their South American service. In outward appearance the vessel, with its battle-gray hull and white superstructure, presents a very pleasing picture, while an inspection of the various decks will disclose all the comforts and luxuries of the modern and up-to-date ocean liner.

In her entirety this vessel has been renovated; in addition to the remodeling of the quarters, an extensive refrigerating system has been installed which provides for the preservation of the various articles of food consumed during a voyage, as well as a cargo of frozen meats. Finally, in accordance with modern practice, the ship has been converted from a coal burner into an oil burner with a system of thirty-six furnaces operating under natural draft.

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Built in 1899 at the yard of F. Schichau, Danzig, Germany, for the North German Lloyd Line, this vessel made her maiden voyage during the winter to Asiatic and Australian ports. The following spring her arrival at New York marked her first transatlantic trip, and from then until the outbreak of the great war in 1914 she plied between New York and Bremen.

At the outset of the war she was interned, with other German vessels then on this side of the Atlantic, and later was seized by the United States Government upon our entrance into the war. The vessel was then turned over to the Navy Department for operation, the name being changed to *Aeolus*. She was then fitted out as a transport and figured in this capacity until late in 1919.

Her war career included several exciting incidents, one being the occasion when she rammed the steamship *Huron*, ex-*Friedrich der Grosse*. Both vessels were in the same convoy and headed for France when, while pursuing a zig-zag course in the submarine zone, the *Aeolus*, due to mistaken signals, was forced by another vessel to bear over against the *Huron*. At the moment of striking, the bow of the *Aeolus* lifted on the crest of a wave and the resultant damage was that the *Huron* caught the blow above the waterline on the

starboard side, amidships, thus narrowly averting a serious catastrophe. Both vessels were forced to put back to New York for repairs but were soon in service again.

Early in 1920 the contract for re-conditioning the *Aeolus* was awarded to The Baltimore Dry Docks and Ship Building Company, and it is this contract which has just been carried to a successful conclusion.

DESCRIPTION OF THE VESSEL

The *Aeolus* is a combined passenger and cargo vessel, carrying first, second and third class passengers. She is of the twin screw type, being driven by two quadruple expansion engines with a total of 9,000 indicated horsepower. The boilers comprise five double end and two single end units. The machinery is located amidships.



Fig. 2.—Children's Playroom

GENERAL ARRANGEMENT

The *Aeolus* has a total of seven decks. There are two superstructure decks: "A," boat deck, and "B," upper promenade deck; "C," lower promenade deck, which is a long bridge and poop combined. Below the bridge deck are "D," upper deck; "E," main deck, and "F," lower deck, all of which extend fore and aft. Below "F" deck there is a "G," orlop deck, beyond the machinery space and extending to the ends of the vessel. Beneath this is the hold of the vessel.

A flying bridge on top of the pilot house and a docking bridge aft give a commanding view in navigating the ship.

A double bottom extends all fore and aft, subdivided for carrying fuel oil and water. The peak tanks are fitted for carrying water ballast. Below the main deck there are fifteen oil- or watertight bulkheads dividing the hold into the fol-



Fig. 3.—Skylight Over Music Room

The following figures give an excellent idea of the size and capacity of the *Aeolus*:

Length overall	580 feet 10 $\frac{7}{8}$ inches
Length between perpendiculars	561 feet 5 $\frac{1}{16}$ inch
Beam, molded	62 feet 4 $\frac{1}{16}$ inches
Depth, molded	39 feet 4 $\frac{7}{16}$ inches
Load draft	30 feet $\frac{1}{2}$ inch
Displacement at load draft	22,450 tons
Gross tonnage	12,642.63 tons
Deadweight tonnage	11,205 tons
Net tonnage	6,992 tons
Speed, loaded	15.5 knots
Steaming radius	18,000 knots
Total capacity of fuel oil tanks	5,866 tons
Ballast and feed tanks	878 tons fresh water
Domestic tanks	1,483 tons fresh water
Cargo spaces	191,041 cubic feet
Refrigerated cargo spaces	58,244 cubic feet
Refrigerated space for ship's use	8,783 cubic feet
First class passengers	194
Second class passengers	171
Third class passengers	114
Crew	234
Total complement	718

lowing compartments: In the forward part of the ship are the fore peak, Nos. 1, 2 and 3 cargo holds, and aft of these are the deep tanks for carrying fuel oil, with a centerline division. Number one and two boiler rooms follow in order, with oil settling tanks on each side and the pump room in between. Then comes the engine room. Aft of the engine room, and below "G" deck, is located the refrigerating machinery space with water tanks on each side. These water tanks extend to the after peak on each side, also between the shaft alleys. Between the main and orlop decks and aft of the engine space, three holds are insulated for carrying frozen meat, and, finally, a space for baggage is provided in the extreme after end of the vessel.

A description of the accommodations provided for the three classes of passengers, the officers and crew shows them to contain everything necessary for the comfort and convenience for the lower classes, and in the case of the higher classes a luxury not surpassed by the most modern hotel. An inspection of the quarters invariably produces exclamations of admiration and the details of arrangement prove interesting reading.



Fig. 4.—First Class Music Room



Fig. 5.—First Class Smoking Room



Fig. 6.—First Class Lobby on "B" Deck



Fig. 7.—Second Class Social Hall on "C" Deck



Fig. 8.—Stairway and Dining Room Lobby



Fig. 9.—Stairway and First Class Lobby on "C" Deck

ACCOMMODATIONS FOR FIRST CLASS PASSENGERS

Accommodations for first class passengers are provided amidships on "B," "C" and "D" decks. The music room, which is located at the extreme forward end, is entered from a lobby with large doors opening to the enclosed promenade. In the center of this music room is a well looking down on the ladies' lounge and below that the main stairway to the dining saloon. Overhead is an art glass dome protected by a heavy steel skylight outside. Electric lights are provided about the dome for illumination at night. Numerous windows all around the sides provide ample light during the day. These windows are glazed with satin glass cut into small squares with a narrow edge of blue all around. Above the windows are silk panels in blue and gold. The seating arrangement is liberal, providing best straight back and comfortable arm chairs as well as numerous large settees. The furniture is all upholstered in blue plush, having a gold background. The floor is completely covered with a tan velvet carpet.

Situated at the after end of the space allotted to first class passengers on this deck is the smoking room, opening onto an open air veranda. Extending the full width of the house, this room is large, well lighted and ventilated, having large sliding windows all around. The side walls are paneled in oak, finished a silver gray. Two girders running the length of the room, as well as the drop beams, are encased in oak, finished to match the side walls. The floor is covered with cork tile, arranged in attractive design.

Heating of the above quarters is by means of steam, the floor type of radiators being used.

Between No. 1 and 2 boiler hatches is located a children's play room. In this room have been placed chairs and tables as well as a plentiful supply of toys of all descriptions. The side walls are painted cream color, with birds and animals in color for decoration. Light is by means of an art glass skylight.

Between the children's play room and the music room forward are three suites on each side, consisting of bed room, sitting room and private bath. Each bed room is equipped with two metal berths, one folding; chiffonier, built-in wardrobe, and two reed chairs. In the sitting rooms are one built-in berth, upholstered seat and back, writing desk and chair, one reed chair and built-in wardrobe. The baths have built-in tubs, water-closet and lavatory, tiled floor and side walls. The floors of the bed and sitting rooms are covered with carpet. The windows and doors are provided with curtains.

Between the children's play room and the smoking room aft are six staterooms with semi-private bath. Each stateroom is fitted with two metal berths, one folding; two reed chairs, one chiffonier, lavatory and built-in wardrobe. The floor is covered with carpet and curtains are provided for doors and windows. The bath has a lavatory, shower and water-closet, and the floor and side walls are tiled.

All rooms on this deck are outside, with doors opening onto an enclosed promenade.

On "C" deck two suites on each side open into the ladies' lounge. These suites are similar in every respect to those described on "B" deck, except that entrance is from the inside.

Seventeen staterooms occupy the remainder of this deck back to the second class accommodations. These are similar to those on "B" deck, except that entrance is by means of an inside passage.

Between No. 1 and 2 boiler hatches are public toilets and baths.

At the forward end of "C" deck, with the suites on either side as previously mentioned, is the ladies' lounge. In the center of this lounge is the main stairway leading to the dining saloon. Pilasters are applied to the side walls, which are painted light gray, plaster ornaments being used for decoration. The ceiling is paneled in small squares, painted white, with numerous ceiling domes. The floor is quartered

oak, finished for dancing and covered with small rugs. As in the music room, the seating arrangement is generous, providing straight back and arm chairs and settees all upholstered in purple.

Just aft of the engine hatch is the library, with a passageway leading fore and aft to the first class rooms on this deck and a stairway leading up to the smoking room or down to the deck below. Here will be found the purser's office and also the doctor's office.

On "D" deck at the forward end of the space under the bridge deck is located the main dining saloon. Extending the full width of the ship, with large air ports on three sides and a large art glass dome overhead, this room is well supplied with light and air. The seating arrangement accommodates all of the first class passengers at one sitting with two, four, six and eight person tables. The floor covering is of blue and white cork tile. Pilasters are applied to the side walls, with flush ceiling. The saloon is painted in white and old ivory.

Immediately aft of the dining saloon and to the port side of the vessel is the galley, pantry and bakery. Installed in these departments are assortments of the most modern equipment for preparing meals, etc., for the first class passengers. The chief steward's office is adjoining.

The first class staterooms on this deck all have private baths. Each stateroom has two metal beds, one folding; two chiffoniers, two reed chairs and one dressing table with bench. The ports and doors are provided with curtains and the floors are covered with carpet. The bath rooms contain a water-closet, shower and lavatory, the floor and side walls being tiled.

ACCOMMODATIONS FOR SECOND CLASS PASSENGERS

Second class passengers occupy the after end of "C," "D" and "E" decks. Each stateroom contains two metal berths, cushion settee, double wardrobe (built-in) and lavatory. The floors are all covered with a deck composition. Public baths are furnished on each deck.

The smoking room and social hall are at the after end of "C" deck. The smoking room is in the form of a semi-circle, with upholstered settees around the sides. The social hall extends the full width of the house, with large windows on each side and art glass skylight overhead.

The dining saloon on "D" deck is fitted out with long tables and straight back chairs with cushion seats, sufficient to seat all second class passengers at one time. Lighting is by means of air ports on each side.

The galley, which is just forward of the dining saloon, and which is smaller than the first class galley, is completely equipped.

ACCOMMODATIONS FOR THIRD CLASS PASSENGERS

All third class passengers are quartered at the extreme forward end of "E" deck, with their galley and mess room on the deck above. The rooms are all fitted to accommodate four persons each, having metal berths with comfortable wire springs and fibre mattresses. Pine benches and metal lockers are fitted. The floors are covered with a deck composition.

ACCOMMODATIONS FOR OFFICERS AND CREW

Except for the officers' quarters on the boat deck the entire crew is taken care of on "E" deck. The engine room crew is grouped about the engine hatch, with storeroom, toilets and mess room all carefully fitted out for the comfort and convenience of the men.

The steward's department is located amidships with two-, four- and six-person rooms for all except the waiters, who are taken care of in two large rooms. The rooms are equipped with metal berths and lockers and wood benches. The floors are all covered with a deck composition.

The miscellaneous units of the ship's equipment, as described below, all tend to make the *Aeolus* complete in every detail. Safe navigation is made certain; heating, ventilation, methods of communication and other necessary installations have been taken care of, and, finally, every means of providing for the safety of passengers and crew at sea has been adopted.

OPERATING EQUIPMENT

Navigation.—On the navigating bridge, or in the pilot house, are located all the instruments necessary for the safe and efficient handling of a vessel of this size. Within view and easy reach of the officers in charge are the compasses, one magnetic and one gyro; docking and engine telegraphs; engine and revolution indicators; submarine telephones; pneumercators, which indicate the draft and displacement; speaking tube; telephone and call bells to all parts of the vessel, and control cabinets for the fire extinguishing system.

Pneumercators.—A complete pneumercator system has been installed for registering, at gages located in the pump room, the depth and capacity of fuel oil in each tank. Another pneumercator system, with gages in the pilot house, has been installed for registering the draft, trim, displacement and deadweight of the vessel.

Steering Gear.—For operating the rudder, a steam tiller is provided, located in the poop at the after end of "E" deck. The engine is steam driven, with double inverted cylinders, and is controlled by a telemotor gear from the pilot house as well as from a station on the after end of "B" deck.

Wireless Telegraph.—Situated on the boat deck, between the two smokestacks, is a steel house in which are quartered the three wireless operators and four cadet officers. This house also contains the battery room and operating room for the wireless telegraph. An auxiliary generator, gasoline driven, used in connection with the wireless outfit, is located in the upper engine room casing just below the skylight.

Heating and Ventilating.—A complete ventilating system has been installed on "D" and "E" decks, including all assembly rooms, quarters, cabins, mess halls, toilet rooms, etc. The mechanical equipment consists of seven supply and six exhaust Sturtevant blower sets, each set having a fan driven by an electric motor. The supply sets are also equipped with tempering coils for tempering the air. The distribution of air is accomplished through sheet metal conduits leading to and from the fans to the various localities. All outlets are fitted with plain lattice pattern grills and registers.

Fire Extinguishing System.—All fuel oil tanks, except the double bottom tanks, have been equipped with steam smothering pipes leading to a common control manifold on "E" deck. For the cargo holds, including the refrigerated spaces, the "Rich" system for detecting and extinguishing fire has been installed, with detecting cabinets located in the wheel house and two control cabinets with steam smothering manifold on "E" deck.

For detecting fire in the passenger quarters, there is provided a patented device with indicators in the pilot house.

Life-Saving Equipment.—To care for the persons on board in case of accident, there are two 20-foot lifeboats and one 30-foot lifeboat of the open type, one 26-foot open motorboat and twelve 26-foot lifeboats of the decked type, with collapsible sides. All of these boats are placed under patented davits. The lifeboat capacity is sufficient to care for all on board.

Cargo Handling Gear.—Cargo gear for handling cargo to the six hatches consists of two masts and two derrick posts, each mast being fitted with eight wood booms operated by four steam winches, and each derrick post fitted with one wood boom operated by one steam winch. The ten winches are double cylinder, single drum, with extended heads.

Anchor and warping gear for handling the anchors consists of a large double cylinder geared windlass, mounted on the forecastle deck.

For handling the heavy lines with which this vessel is equipped there are four steam-driven capstans. Two capstans are located on the forecastle deck and two on the after end of "C" deck. Bitts, chocks and roller fair leads are generous in number and of heavy construction.

On the boat deck are two steam winches with fair leads to each davit for hoisting the lifeboats.

Generating Plant.—The old electric generating plant, consisting of three German 35-kilowatt generators, driven by reciprocating steam engines and one 35-kilowatt General Electric turbo-generator, have been overhauled and re-arranged. A new 100-kilowatt General Electric turbo-generator has also been added.

Machine Shop.—On the port side of No. 2 boiler hatch, on "E" deck, is a completely equipped machine shop.

Laundry.—On the starboard side of No. 2 boiler hatch, on "E" deck, is provided a laundry of ample size to care for the needs of the entire vessel.

PROPELLING MACHINERY

The machinery of the *Aeolus*, hereinbefore mentioned, consists of the following:

The two quadruple expansion marine engines, with a total of 9,000 indicated horsepower, and driving two 17-foot 9-inch diameter propellers, have been thoroughly overhauled and put in first class condition.

Five double end boilers, 14 feet 2 inches diameter and 20 feet long, and two single end boilers, 14 feet 2 inches diameter and 10 feet 3 inches long, each built for a pressure of 220 pounds, have been converted from coal to oil burning.

The fuel oil burning equipment is of the mechanical atomizing type, two sets being furnished, each being capable of supplying the whole boiler plant, and each set consisting of the following:

Two 7½-inch by 4½-inch by 10-inch horizontal duplex oil service pumps.

Three oil heaters.
One suction strainer.
One discharge strainer.
One oil meter.
One regulating valve.
One steam trap.
Three thermometers.
Two pressure gages.

Both fuel oil sets, as well as a 10-inch by 10-inch by 12-inch horizontal duplex fuel oil transfer pump and all fuel oil manifolds, are located in the pump room, which is entirely watertight. This condition contributes greatly to the safety of the vessel, as with this arrangement either boiler room may be flooded while the other may still be served from the pump room.

Two old feed pumps, the grease extractor and feed heater have been removed and replaced by two 18½-inch by 13½-inch by 24-inch vertical simplex feed pumps of Worthington make; one Row & Davis feed water filter and grease extractor and one Row & Davis No. 36 Paracoil 2-pass feed water heater. A 10-inch by 20-inch by 16-inch vertical simplex featherweight auxiliary air pump, Worthington make, has been installed and oil fire pump has been replaced by a 12-inch by 14-inch by 12-inch vertical duplex Worthington pump.

The evaporating and distilling plant has been entirely renewed, the new installation consisting of:

Two 40-ton Row & Davis evaporators.
One 40-ton Row & Davis distiller.
One No. 30 Row & Davis aerating filter.

REFRIGERATING PLANT

The refrigerating equipment on the *Aeolus* was designed, manufactured and installed by the Frick Company, Waynesboro, Pa. It consists of two carbon dioxide machines of the straight line tandem type wherein the compressor is placed



Fig. 10.—Enclosed Promenade on "B" Deck

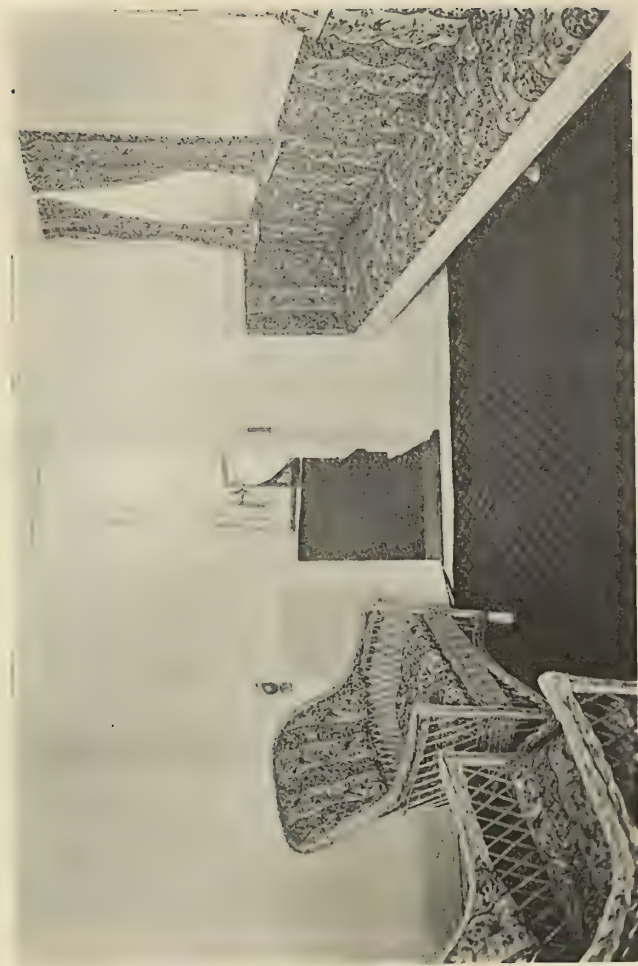


Fig. 11.—En Suite Rooms on "C" Deck

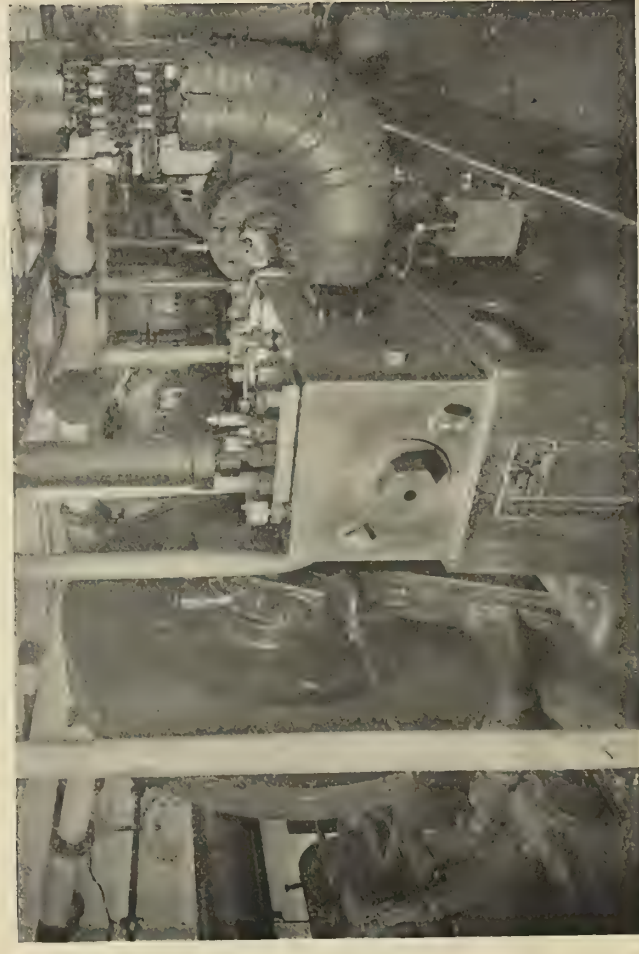


Fig. 12.—Refrigerating Machinery Space

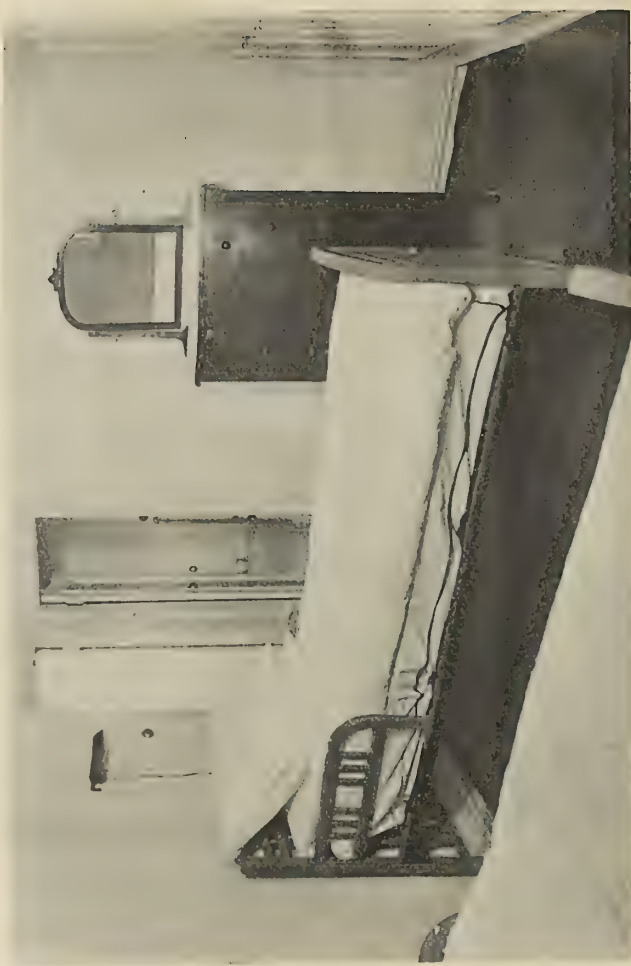


Fig. 13.—Bed Room on "C" Deck

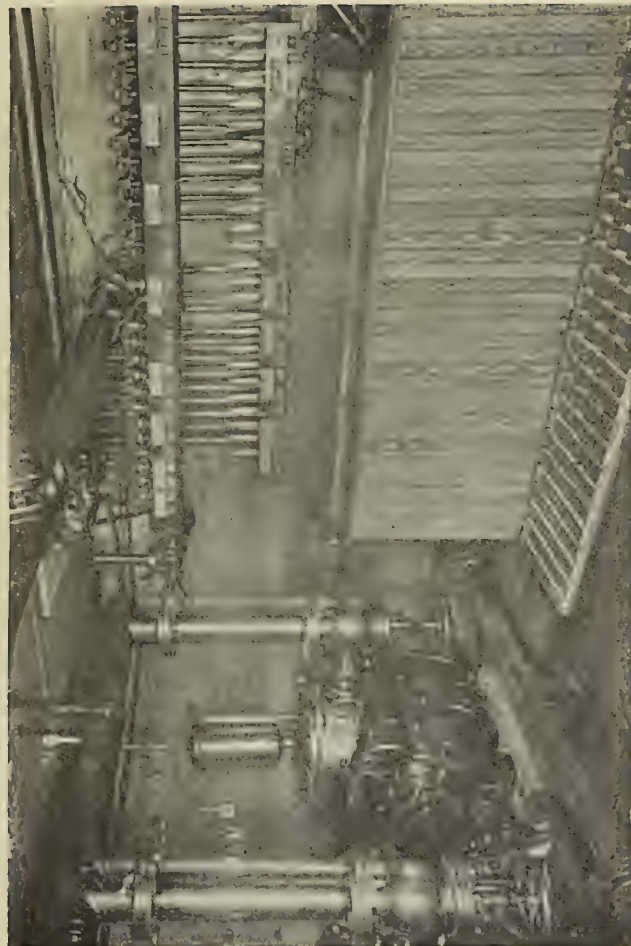


Fig. 15.—Brine Pump and Tanks

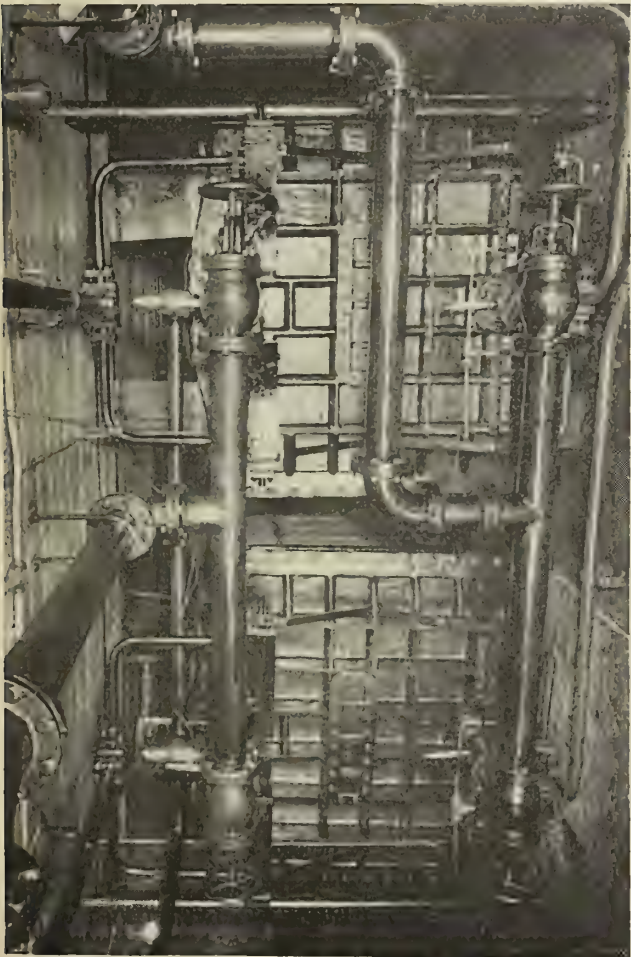


Fig. 14.—CO₂ Condensers



Fig. 16.—Refrigerated Cargo Space on "F" Deck



Fig. 17.—Fruit Room

behind and in tandem to the steam cylinders of a tandem compound steam engine. The carbon dioxide cylinders are $6\frac{1}{2}$ inches bore by 18 inches stroke and the steam cylinders are 13 inches and 24 inches in diameter respectively for the high pressure and low pressure and 18 inches stroke. Each of these machines has a rated capacity of 80 tons refrigeration at 80 revolutions per minute, and together with the condensers and evaporators each has ample capacity to take care of the six cargo holds, small refrigerator boxes in first and second class galleys, first class bar, an ice making tank and an ice water circulating system. Actual cooling in the refrigerated spaces is done by the cold brine circulating method, the brine being cooled by the expansion of the carbon dioxide gas in the evaporators.

The refrigerated cargo holds are located at Nos. 4, 5 and 6 hatches between "E," "F" and "G" decks and are designated as F-4, G-4, F-5, G-5, F-6 and G-6. Their total capacity is approximately 102,000 cubic feet and they are piped with $1\frac{1}{4}$ -inch brine pipe at a ratio of 4 cubic feet of space per lineal foot of pipe, making a total of approximately 26,000 cubic feet of pipe.

CARBON DIOXIDE COMPRESSORS

The two carbon dioxide compressors are located in a room under hold G-4 just aft of the dynamo room. G-4 is divided in half by an athwartship insulated partition. The after half into which No. 4 hatch opens is devoted to refrigerated cargo and the forward half is used as condenser and evaporator room. This forward half is further divided by a fore and aft insulated partition, thus making two rooms. The two condensers and condensing water pumps are located in the starboard room and the two evaporators, brine pumps, the brine return tank and the brine feed header are located in the port side room. Entrance to the compressor room is had by means of a small hatchway in the floor of the condenser room with a stair leading down.

The crank shafts of the carbon dioxide compressors are of the double bearing single throw type with fly wheel mounted between the bearings. The compressor cylinders are made from a solid block of nickel steel bored true and ground smooth through the working barrel and are fitted with nickel steel suction and discharge valves working in nickel steel cages. High and low pressure steam gages, vacuum gage and brine pressure gage are located in the engine room within easy view of the engineer and a carbon dioxide high pressure alarm gage was provided which sounds an electric alarm in case of an abnormally high pressure. Steam at 150 pounds pressure is used, being taken through a reducing valve from one of the ship's steam lines carrying boiler pressure at 200 pounds pressure and exhaust line is connected to one of the ships condensers, the steam engines thus operating condensing.

CONDENSERS

There are two carbon dioxide condensers of the shell and coil type with removable heads, each containing 5,032 feet of $\frac{3}{4}$ -inch extra heavy copper pipe made up in twelve separate coils. Two duplex steam driven water pumps, size 7 inches by $7\frac{1}{2}$ inches by 10 inches, each having a capacity of 300 gallons per minute, furnish water for these condensers. Sea water is used for condensing and it is taken from a suction line through the ship's side and discharged overboard after passing through the shells.

In the condenser room there is a set of high and low pressure carbon dioxide gages for each compressor and the necessary carbon dioxide charging apparatus consisting of another gage, scale and heating tank, etc. All steam and water lines are made of copper pipe and thermometers are provided where necessary to aid the operators in securing proper operation.

The evaporators are of similar construction to the condensers and consist of two shells, containing extra heavy

iron pipe, however, in place of copper pipe. Each shell contains 6,988 feet of 1-inch extra heavy pipe made up in twelve coils. There are two brine pumps, size $7\frac{1}{2}$ inches by $10\frac{1}{4}$ inches by 10 inches, duplex steam driven, each having a capacity of 300 gallons per minute. The bases of these brine pumps are provided with extension pieces and the pumps are located so that the steam cylinders are in the condenser room and the brine cylinders in the evaporator room and the insulated partition is built around the beds of these pumps. This does away with the cumbersome insulation over the steam cylinders of the pumps which is necessary when the pumps are placed in the cold room.

BRINE MAINS

Warm brine leading from the various refrigerated holds, ice tank and boxes comes into the evaporator room through 1-inch mains and pours into a return tank. The brine pumps take it from this tank and force it through the evaporators, where it is cooled again and it then passes to the feed headers. From this header 1-inch feed mains carry brine to all parts of the ship where refrigeration is required. Every feed and return main has a control valve, and designating boards are provided on the feed header and return tank showing exactly what each valve controls. Thermometers are provided on each return main and the return tank, as well as on the inlet and outlet of the evaporators.

There is a brine heater to warm the brine when defrosting the coils in the refrigerated spaces. It is made of cast iron shell with a special steam coil inside and so connected that it can be cut in and out at any time desired.

TEMPERATURES OF REFRIGERATED SPACES

A temperature of 15 degrees F. is maintained in cargo holds F-6, G-6, F-5, G-5 and G-4, these being designed for carrying frozen beef. Hold F-4 is subdivided into four rooms for carrying ship's stores, such as meats, eggs, butter, cheese, vegetables, etc., and temperatures are maintained in these rooms to suit the nature of the contents. Thermometer tubes lead from the refrigerated holds up to "B" deck with two thermometers in each hold hung on brass chains fastened to deck blocks. This makes it possible to take temperatures in the holds by opening the deck blocks and pulling up the thermometers.

The $1\frac{1}{4}$ -inch brine piping in the holds is arranged in ceiling and wall coils connected in circuits averaging 1,200 lineal feet each and fed from the brine header in the evaporator room. Removable hatch coils are provided with special four-way brine cocks on each coil, so constructed that a coil can be cut off and removed without losing any brine. Watertight ferrules are provided where feed and return mains pass through decks and bulkheads on way to evaporator room.

There is a scuttle butt for cooling drinking water. It consists of a round galvanized tank with spiral brine coils inside and the water is continuously circulated to drinking fountains in all parts of the ship by means of a 1-inch centrifugal motor driven pump. There is also a duplicate pump which is used as a reserve.

The ice making equipment has a capacity of one-half ton per day and is used for making ice for table use, etc.

There is a three-compartment refrigerator installed in the first class galley, two-compartment box in the second class galley, and a small box in the first class bar. These boxes are piped with 1-inch brine coils and also fed from the main header in the evaporator room.

INSULATION

All refrigerated spaces are insulated with compressed corkboard insulation. In the holds F-4, F-5 and F-6, 2-inch by 3-inch wood grounds were bolted to the ship's frames on ceiling and walls with a layer of $\frac{7}{8}$ -inch tongued and grooved sheathing nailed to this followed by layer of 3-inch and then a layer of 2-inch corkboard. This was then finished by a

layer of 1½-inch tongued and grooved spruce sheathing. Waterproof paper was placed between each layer of sheathing in coils and between the courses of 2-inch and 3-inch corkboard. The spruce sheathing was finished with two coats of shellac.

An insulated ribbon was built around the ship's sides and exterior bulkheads on "F" deck extending 3 feet from the ship's side.

The insulation of G-4, G-5 and G-6 is similar to the "F" deck, with the exception of the floors, where 6 inches of corkboard with two layers of 3 inches each was laid in hot pitch and a finished spruce flooring was nailed to ground imbedded in the coils. A 3-inch hardwood floor was built under the hatches extending out 1 foot each way beyond the edge of the hatch in order to secure protection to the insulation when loading cargo. Heavy beveled yellow pine timbers were bolted to the hatch coamings and strong backs and removable insulated plugs fitted in them so that when cargo is loaded the holds can be completely sealed up.

Proper tests were run on the refrigerating equipment consisting of an 18-hour run while the ship was at anchor and a 12-hour operation during the sea trial of the ship when it was taken to New York. On reaching New York another 24-hour trial was run. In all the tests highly satisfactory results were secured. The desired temperatures were easily obtained in all the refrigerated spaces and the operation of all the refrigerating equipment was found to be all that could be desired.

Taken all in all, the *Aeolus*, completely equipped in every detail, should, under the operation of the Munson Steamship Company, to which she has been allotted by the United States Shipping Board, prove popular with tourists and travelers and serve to cement our friendly relations with the South American countries. As she now stands, the *Aeolus* in her reconditioned state is a credit not only to the Baltimore Dry Docks & Ship Building Company and to her operators, the Munson Steamship Line, but also to the merchant marine of the United States.

Steam Engine Driven Exciter Sets

THE recent application of alternating current propulsion equipment to the *Eclipse*, the first of twelve ships to be similarly equipped by the United States Shipping Board, has called attention to another use for the small direct current steam engine driven generating set aboard ship.

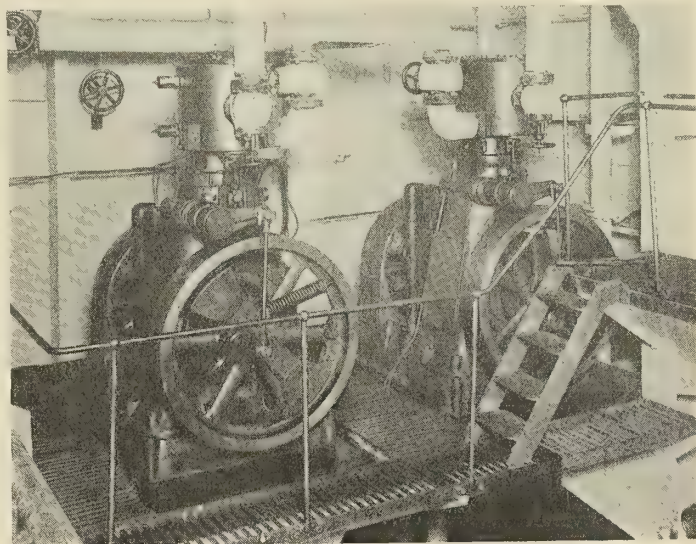
Hitherto the marine application of these sets has been more or less confined to lighting purposes, but on these vessels they have been applied to supply energy for several different purposes. Two 35-kilowatt sets of this type have been installed on the *Eclipse* to furnish field excitation current to the alternator, besides which they furnish 125-volt, direct current power to operate contactors on the control board and to run the blower motor.

Generating sets similar in design to these, and ranging in capacity from 2½ kilowatts to 60 kilowatts, are made by the General Electric Company, primarily for marine purposes. They are, however, equally adaptable to various uses on land, such as supplying light and power in isolated plants and shipyards and as exciters for alternating current generators in central stations.

The complete set consists of a single cylinder steam engine directly connected to a direct current generator. The cylinder and stroke of the engines vary from 3½ inches diameter by 3 inches stroke for the 2½-kilowatt size to 12 inches by 11 inches for the 60-kilowatt size. Only one valve is used, and a short stroke has been adopted. The cylinders are separate from the column casting. Since the ports are short and direct, small clearance space is allowed. Automatic relief valves, to relieve water under ordinary operating conditions, and separate hand operated drain valves are fitted to each

end of the cylinder. The steam distribution is accomplished through a single balanced piston valve, driven either by an eccentric strap or by a pin from the governor weight.

Governing is accomplished by two methods, depending upon the size of the engine. The 3½-inch by 3-inch, 4½-inch by 4-inch, 11-inch by 8-inch, and 12-inch by 11-inch cylinder engines are equipped with a flywheel type automatic governor, while the other sizes, from 5-inch by 4½-inch to 9-inch by 7-inch, have an enclosed type which is inside the column. In the latter type the piston valve is connected to



Exciter Sets on the *Eclipse*

the governor by an eccentric strap. The length of the valve stroke depends upon the distance of the center of the eccentric from the center of the shaft, and therefore the amount of steam admitted to the cylinder varies directly as the distance between centers. That is to say, the shorter the valve stroke the smaller the amount of steam admitted. If the speed reaches a dangerous point, the throwing out of the governor makes the valve stroke so short that no steam is admitted to the cylinder.

LUBRICATING SYSTEM

The lubricating system also differs with the capacity of the engine. Those in the range from 2½ to 5 kilowatts employ a gravity system, the oil being contained in a conveniently located tank and supplied to the various bearings by a number of sight feed tubes. The other sizes are equipped with a forced lubrication system, which functions as follows: The bottom of the column, or crank case, forms an oil tank of large capacity and radiating surface. A small single acting plunger pump driven by an eccentric which is bolted to the crank shaft forces the oil, under pressure, to the various bearings of the engine. From the bearings the oil escapes and is collected again in the bottom of the crank case, where it cools, and is used over again.

The engines can be operated on pressures up to 125-pound gage, either condensing or non-condensing. When the pressure is above 125 pounds a reducing valve should be used. These engines will operate successfully on moderately superheated steam as used aboard ship.

All parts which would be seriously damaged by corrosion due to the action of salt air are either made of corrosion resisting material or given a protective treatment. The generators are regularly wound for either 110, 125 or intermediate voltages, and the series windings on the field spools will allow of over compounding up to 5 percent of normal, by means of a German silver shunt connected across the field terminals.

New Design of 10,000-Ton Tanker

Tankers Built on New Transverse System of Framing Designed by Chief Surveyor of British Corporation

THE accompanying plans illustrate a new type of tank steamer, several of which are at present being constructed by Sir W. G. Armstrong Whitworth & Company, Limited, at their Armstrong yard, Newcastle-on-Tyne, England. This firm, which has had a long and varied experience in the construction of tankers, having built more vessels of this type than any other firm, has been entrusted by British Tanker Company, Limited, with the construction of several vessels of this new type. The efficiency and reliability of the service of the previous tank steamers built by this firm is an augury of the success of these vessels.

Each of these vessels is built for the carriage of oil in bulk and a special feature of the design is that cargoes ranging in density from 35 to 51 cubic feet per ton can be carried without leaving any of the main compartments empty, thereby avoiding a condition productive of severe straining actions upon the structure. This desirable arrangement has been obtained without increasing the free surface beyond that usually found in tank steamers of this size.

PRINCIPAL DIMENSIONS

The principal dimensions of the vessels are as follows:

Length overall	455 feet	1 inch
Length between perpendiculars	440 feet	0 inches
Breadth, extreme	57 feet	6 inches
Breadth, molded	57 feet	2 inches
Depth, molded to upper deck	33 feet	11 inches
Mean loaded draft	26 feet	3 inches
Deadweight	10,100 tons	

GENERAL ARRANGEMENT

Each vessel is of the two deck type with poop, bridge and forecabin, the poop being of sufficient length to cover the engine and boiler space.

The oil forming the cargo is carried in nine double tanks divided into three groups by two pump rooms. Stowage for oil fuel is provided in two cross bunkers, one forward and one aft, and when it is desired to undertake voyages of exceptional length additional oil fuel can be carried in the forward deep tank. A cofferdam is worked at each end of the cargo tanks and cross bunkers, and between these limits the main deck is parallel to the base line, the height of 'tween decks being determined by the capacity required for the oil of greatest density provided for.

The total capacity of the main holds with their expansion trunks is sufficient for a full cargo of petroleum, but the tanks at the sides of the trunks must be utilized when carrying spirit. Each main tank and each side tank is fitted with a separate hatchway, those to the side compartments having deep coamings to serve as expansion trunks.

In addition to the stowage arranged for oil fuel, coal bunkers are fitted in the 'tween decks directly over the boilers with chutes leading to the stokehold.

Water ballast can be carried in the fore peak, after peak, fore deep tank and double bottom tank under the engines. Boiler feed make up water is carried in the double bottom under the boilers.

The space forward between the upper deck and the top of the deep tank is fitted as a cargo hold.

Ample storeroom space is provided throughout the vessel.

The vessel has two masts, each carrying two derricks, one on the fore side and one on the after side, and two steam winches for working these derricks. A large warping winch is also fitted on the poop deck aft.

In addition to the usual bollards, a large towing bollard is fitted at the after end of the vessel, with a bridle arrangement to the wing bollards, so that derelicts may be taken in tow.

ACCOMMODATIONS

The accommodations, which are more elaborate and extensive than is usual in vessels of this type, are arranged as follows:

Seamen and firemen in the forecabin and on the upper deck forward, the men being berthed not more than two in one room. The mess rooms are commodious and every attention has been paid to the sanitary and washing arrangements.

Officers are accommodated on the bridge deck, upper bridge and flying bridge in large and airy rooms, their comfort having been specially considered.

The engineers' quarters are situated in the poop aft of the engine casing, the style and fittings being similar to that of the officers.

Petty officers' quarters are also arranged in the poop, at the sides of the engine casing, as are their mess room, entrances, etc.

Storerooms, hospital, etc., are placed in the bridge with doors opening directly to the deck.

The galley is fitted in the engine and boiler casing and equipped with all necessary cooking appliances.

Refrigerating machinery and cold chambers are arranged on the second deck aft of the engine room, the machine being placed in such a position as to be constantly under the supervision of the engineer.

HULL

One of the unique features of the vessel is the structural framing which is being carried out on the Foster King transverse system. For many years the transverse system of construction in oil tankers has suffered as compared with the Isherwood longitudinal system on account of the greater weight of structure in the former as compared to the latter. J. Foster King, of the British Corporation, has patented a system of transverse framing in which the total weight will certainly not exceed that of the longitudinally framed vessel.

In this system a number of deep longitudinal girders are fitted to the bottom and sides of the vessel and also to the center bulkhead. At the transverse bulkheads these girders are carried athwartships, while one or more deep floors are arranged in each oil compartment according to its length. The deep girders on the transverse and fore and aft bulkheads are so arranged that alternate tanks are left clear for calking.

The transverse framing has been reduced, and, as already stated, a considerable saving in the structural weight has resulted compared with the old transverse framed tanker. In addition, the erection has been simplified and the riveting reduced to a minimum.

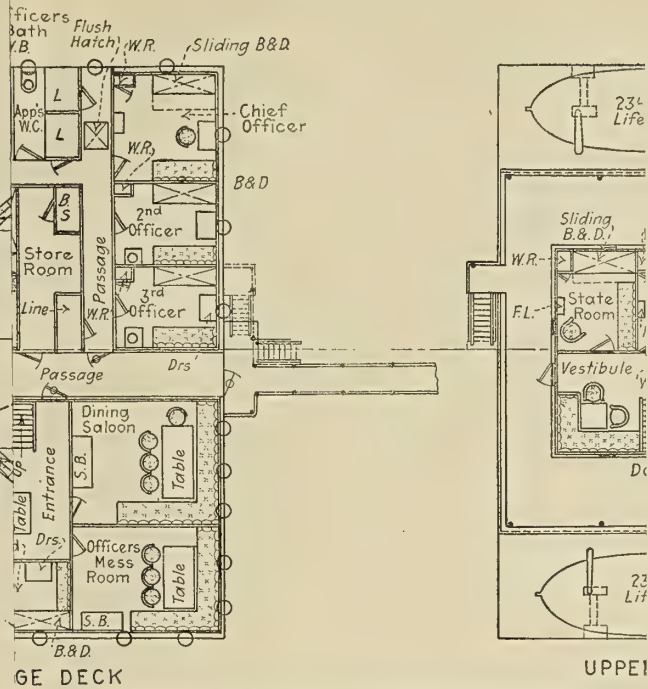
MAIN PROPELLING MACHINERY

The vessel is propelled by a single set of triple expansion engines of 3,000 indicated horsepower having cylinders 27 inches, 46 inches and 77 inches diameter by 51 inches stroke. A complete set of auxiliary machinery is being installed.

BOILERS

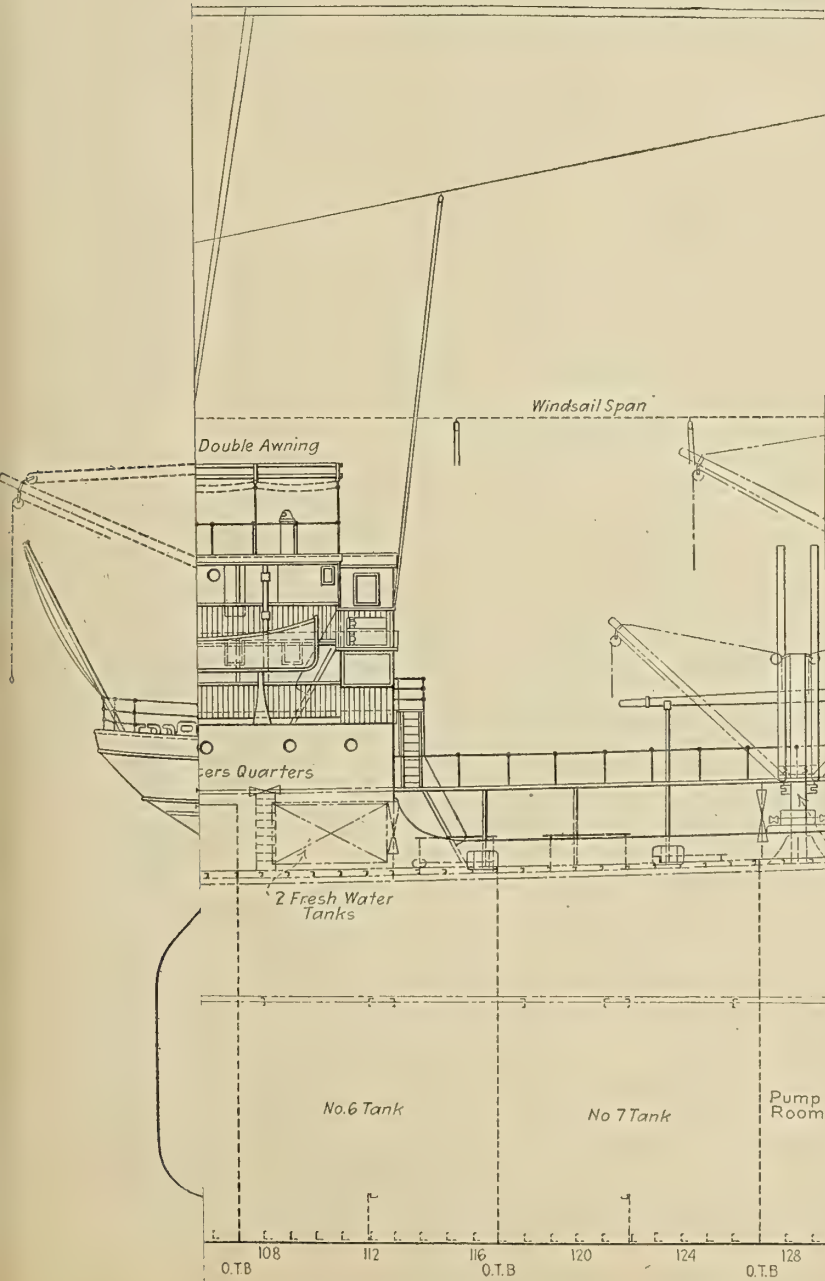
Steam is generated in four watertube boilers of the Babcock and Wilcox type working at a pressure of 200 pounds per square inch with a closed duct forced draft arrangement, the

N TANKER



GE DECK

UPPER



Upper Deck, Molded, 33 Feet 11 Inches; Deadweight Carrying

NEW DESIGN OF 10,000-TON TANKER

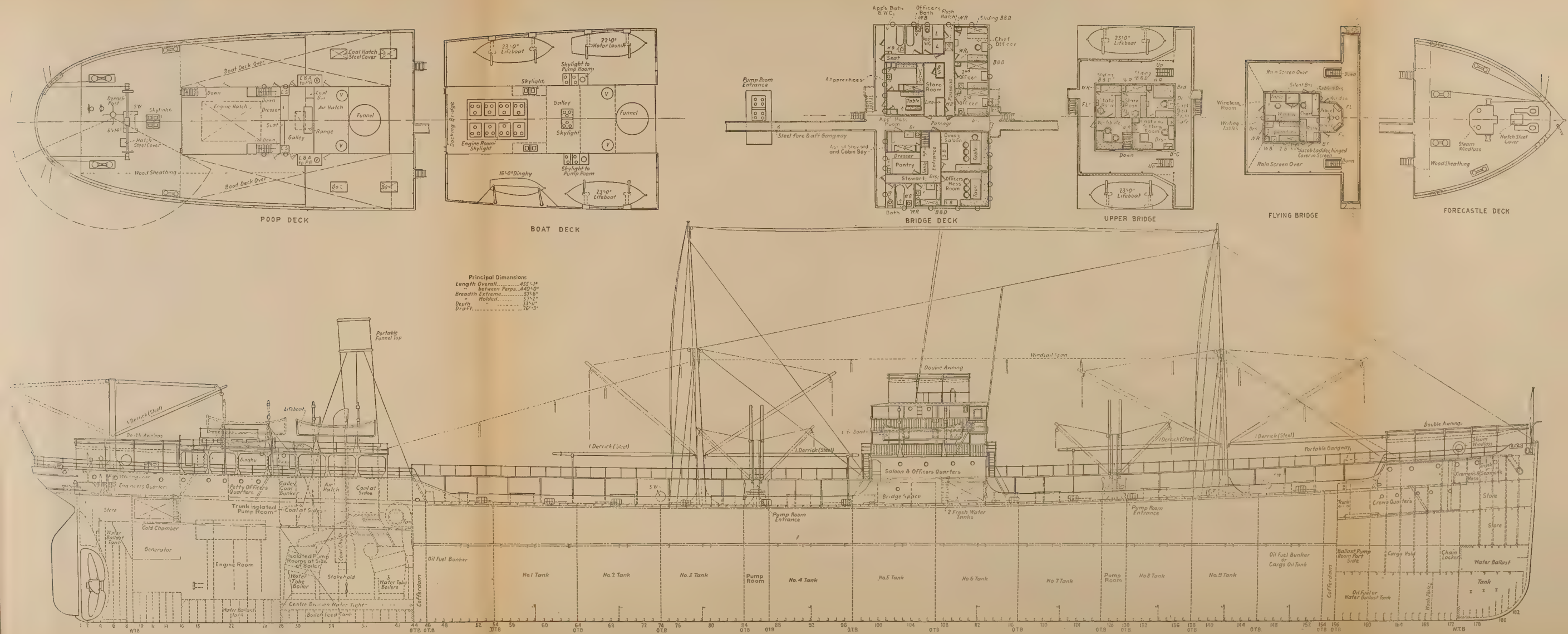
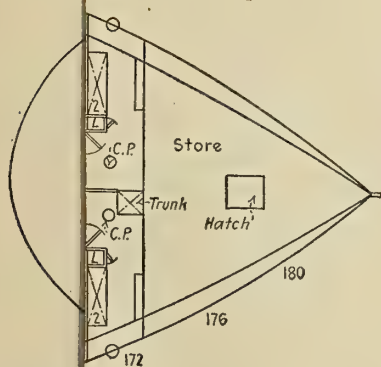
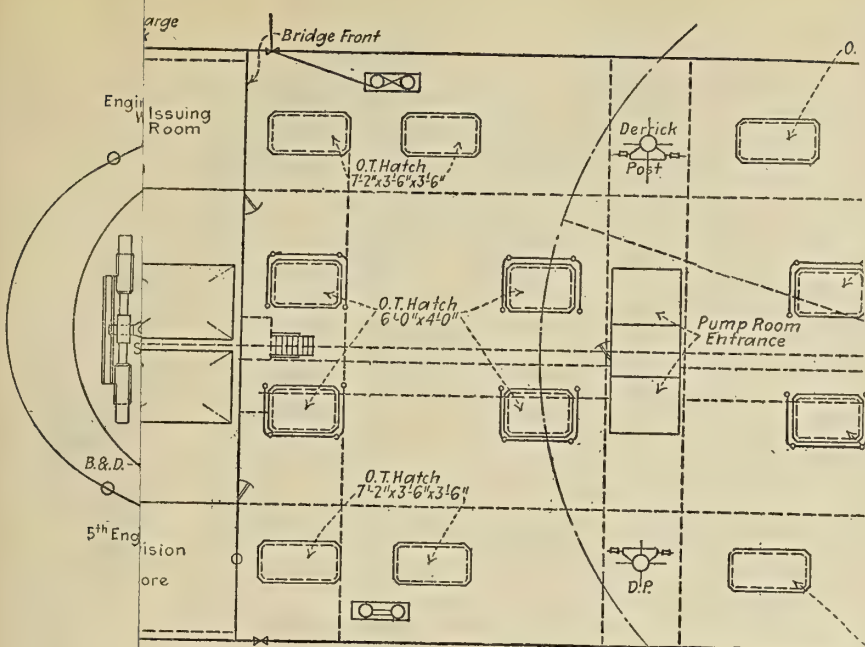


Fig. 1.—J. Foster King Type Tanker: Length Overall, 455 Feet 1 Inch; Length Between Perpendiculars, 440 Feet; Beam, Molded, 57 Feet 2 Inches; Depth to Upper Deck, Molded, 33 Feet 11 Inches; Deadweight Carrying Capacity, 10,100 Tons

ANKER



SOLE

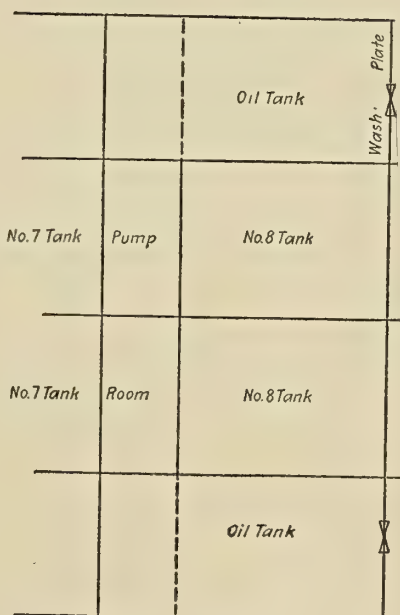
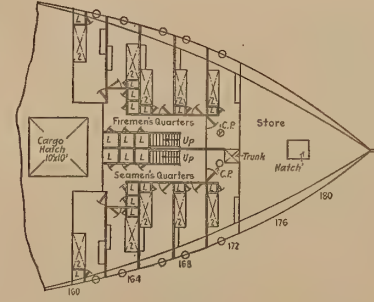
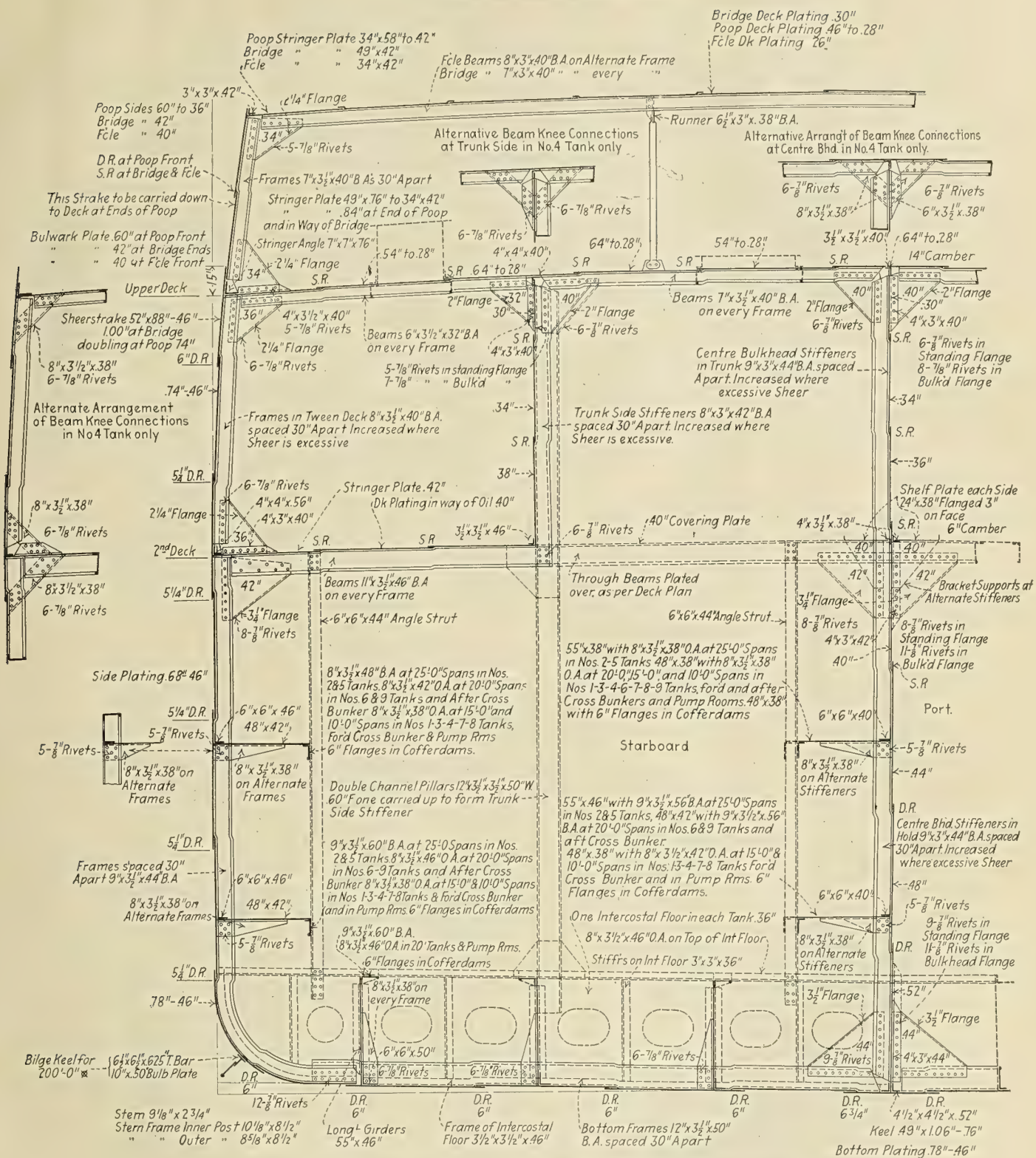


Fig. 3.—Midship Section



Bridge Deck Plating .30"
Poop Deck Plating .46" to .28"
File Dk Plating .26"



PARTS OF STRUCTURE ARRANGED FOR HYDRAULIC RIVETING

EQUIPMENT /

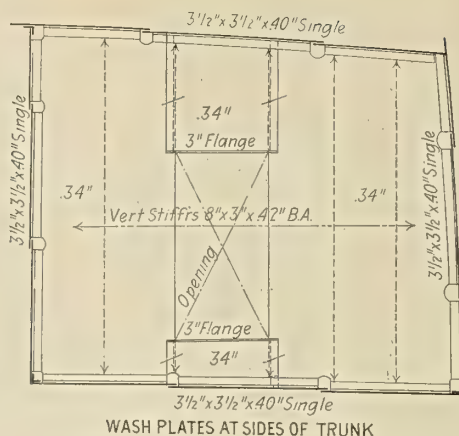
EQUIPMENT		
1 bower anchor, stockless.....	83	cwts.
1 bower anchor, stockless.....	83	cwts.
1 bower anchor, stockless.....	70½	cwts.
1 stream anchor, ex stock.....	24	cwts.
1 kedge anchor, ex stock.....	10	cwts.
300 fathoms 2 6/16-inch stud chain cable.....	845.7	
90 fathoms 1 5/16-inch stream chain or 4¾-inch S. W.		
130 fathoms 5½-inch S. W. towline		
90 fathoms 8½-inch Manila		
90 fathoms 8½-inch Manila		
90 fathoms 7½-inch Manila		
90 fathoms 7½-inch Manila		

EQUIPMENT TONNAGE	
Tonnage under freeboard deck.....	6,389
Poop, bridge and forecastle.....	377
Casing	37
Deckhouse amidships	51
Deckhouse amidships	18.5
Wheelhouse, etc.	8.5
	6,876.0

Fig. 3.—Midship Section



SKETCH OF BULKHEAD LINERS
IN WAY OF OUTSIDE STRAKES OF
SHELL PLATING



WASH PLATES AT SIDES OF TRUNK

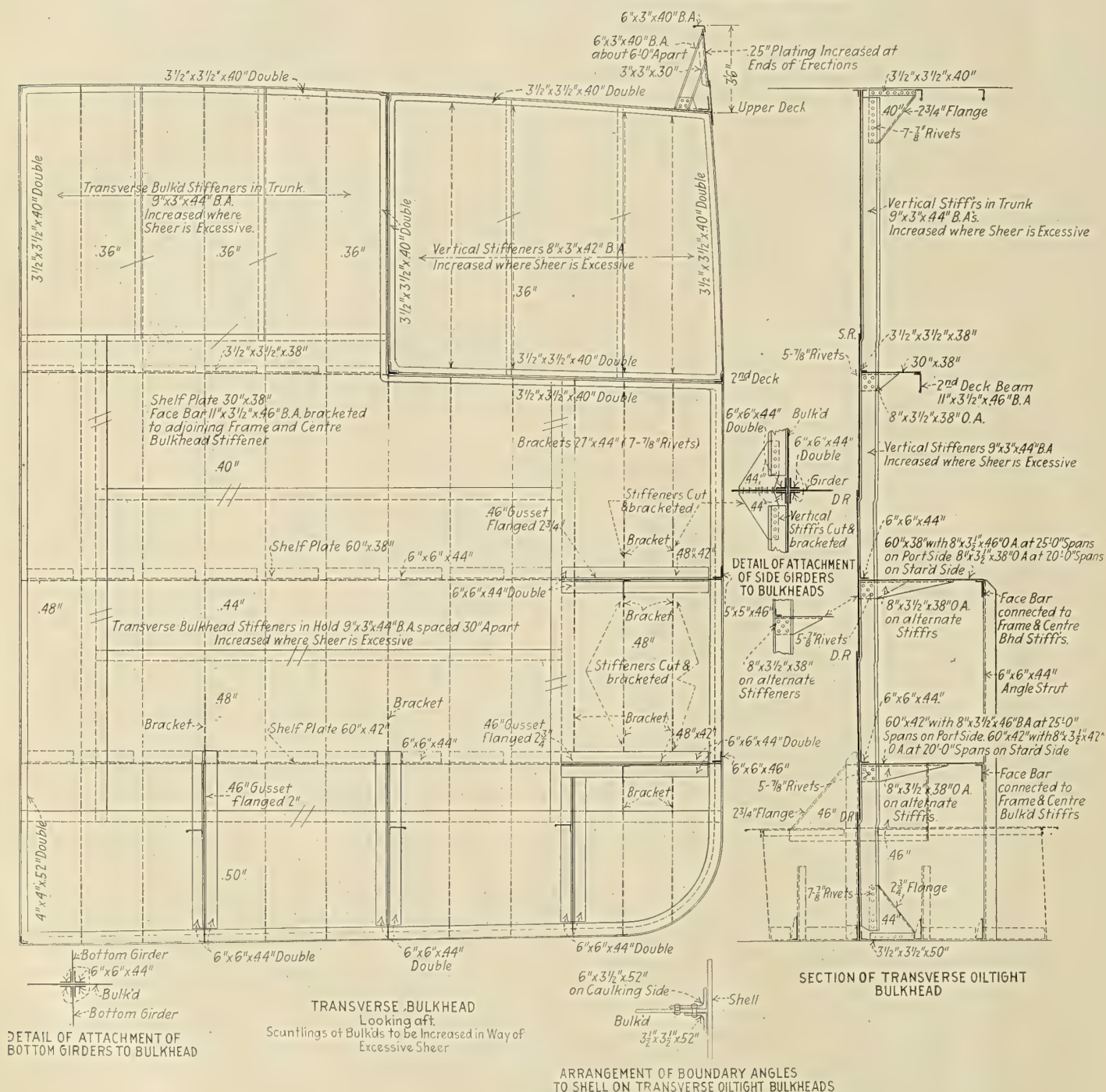


Fig. 4.—Bulkhead Details

furnaces being fitted for burning oil and coal. The boilers are of such size as will enable them to supply steam to various oil tanks for cargo heating, a complete system of heating coils being installed having sufficient heating surface to liquefy the heaviest class of oil carried.

FUEL OIL SYSTEM

The fuel oil pumping arrangements have been well considered. A large transfer pump is fitted in the fore pump room capable of drawing fuel from the deep tank, fore peak and fore and after cross bunkers and discharging to deck or overboard as necessary. This piping is so arranged that oil can be pumped from any one of these tanks to any other. By this means a level keel can always be maintained irrespective of the class of cargo carried.

Two settling tanks, each containing one day's supply, are arranged at the after end of the summer tanks abreast the after cross bunker.

Arrangements are also being made for the burning of low flash oil, the details of which cannot be published at present, but which will be such as will meet the classification society and Board of Trade requirements and prove efficient in service.

CARGO PUMPING ARRANGEMENT

Great attention has been paid to the oil pumping arrangements. The cargo oil is dealt with by three oil pumps, each capable of discharging 300 tons of oil per hour, even when pumping the heaviest class of oil. The oil piping is arranged so that the pumps can deal with the oil in every conceivable way, large double suction pipes being fitted to each tank,

discharging to each side of the deck and over the stern, the total number of discharges being nine. Drain valves are fitted in the summer tanks, each of these valves being controlled from the upper deck.

The details of this system are all in accordance with the builders' latest and most approved practice.

A large ballast pump is placed in the forward ballast pump room for dealing with the water ballast in the fore deep tank and fore peak.

An efficient system of gas freeing and vapor pipes has been arranged throughout the oil compartments and every precaution taken to reduce the possibility of fire due to dangerous gases.

ELECTRICAL INSTALLATION

The electrical installation consists of two steam-driven generating plants, each dynamo being of ample size to run all lights, wireless, fans, steering gear, workshop machinery, etc., without heating.

Electric fans, bells and telephones are fitted throughout the vessel.

Life saving appliances are of the most up-to-date type, Welin davits being fitted for working the four lifeboats and motor launch.

The usual deck machinery is installed, the principle departure from the average tank vessel being that an electric hydraulic steering gear is fitted on the rudder head and controlled from amidships by telemotor gear.

The fittings throughout the vessel will be of first class make and description and there is little doubt that the vessels, when completed, will prove to be highly successful and efficient.

Electric Steering Gear on Standard Oil Company Barges

THE three steel barges *Buffalo Socony*, *Rochester Socony* and *Utica Socony* built for the Standard Oil Company of New York by the Bethlehem Shipbuilding Corporation, Limited, present two notably outstanding features in that they are self-propelled and electrically steered. They are designed to carry oil in bulk and will be placed in service on the New York State Barge Canal.

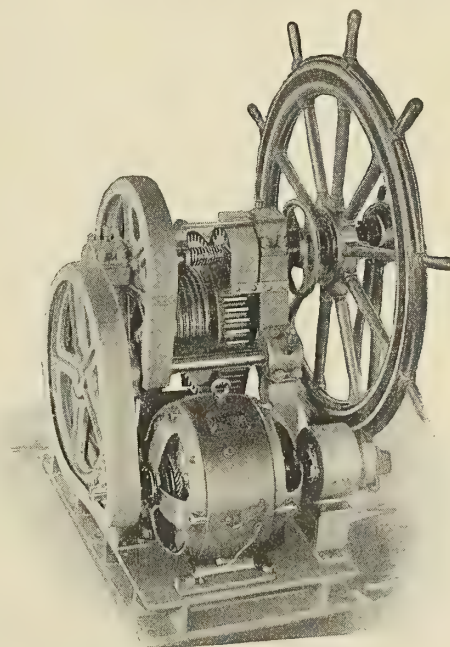
These barges are 156 feet long and are listed at 690 tons deadweight. They are driven through a single screw, and the propelling power is furnished by an oil engine which also runs a generating set of sufficient size to furnish the electricity required to operate the electric steering gear.

The electric steering gear is of the drum type, specially designed to combine light service with a very compact arrangement, giving flexibility of installation and economy of space. It was designed by the auxiliary machinery department of the Bethlehem Shipbuilding Corporation, Limited, and built at their Moore plant, Elizabethport, N. J. All working parts of the steerer, including the motor and brake, master switch, drum, handwheel and the required gearing, are mounted on a single base measuring 25 inches by 41¾ inches. This compact arrangement makes it possible to place the entire gear in the pilot house.

The motor which drives the steering gear is of the compound wound, direct current type, rated at 3 horsepower, 110 volts. It is provided with ball bearings and is suitable for 100 percent overload for five minutes. The motor is controlled by means of a magnetic control panel operated by a master switch at the steering stand. A shift of the master switch to the right or left causes the motor to be operated through the magnetic panel in the required direction. Power is transmitted from the motor through triple gears and drum to the quadrant on the rudder stock by means of a ¾-inch extra flexible steel wire rope. When the switch is brought

back to the central, or off, position, the line is disconnected and the motor is stopped by means of a quick-acting shunt brake. Electrical dynamic braking is also provided.

A rudder indicator mounted on the framework of the steerer shows the position of the rudder at all times. When



Bethlehem Electric Steering Gear

the rudder reaches a hardover position a gear limit switch disconnects the power, stops the motor and prevents damage due to operating the steering gear beyond the working rudder angle.

The steerer is provided with a 60-inch handwheel for use

when it is desired to steer by hand. Shifting from electrical steering to hand steering is accomplished by moving a clutch wheel, which shifts two jaw clutches so that when the hand steering wheels are connected to the drum the motor is simultaneously disconnected, and vice versa. When the gear is connected up for hand steering the clutch is held in place by a spring latch, so that when it is desired to shift to electrical

steering the spring latch is raised and a steel coil spring automatically moves the clutches to the required position. This renders it impossible for the motor and handwheel to be connected to the drum at the same time and eliminates all danger of accidents from this source.

This type of electric steering gear is suitable for service on river barges, yachts or any other light draft vessels.

The Motorship Narragansett

10,000-Ton Tanker Equipped With Oil Engines Using the Vickers System of Solid Injection of Fuel Oil

THE *Narragansett*, a motor-driven oil tank vessel built by Messrs. Vickers, Limited, at Barrow-in-Furness for the Anglo-American Oil Company, Limited, carries 9,420 tons of cargo plus 520 tons of fuel and stores.

PRINCIPAL DIMENSIONS

The principal dimensions of the vessel are as follows:

Length between perpendiculars.....	425 feet 0 inches
Breadth, molded	56 feet 8 inches
Depth to upper deck, molded.....	33 feet 0 inches
Mean draft	26 feet 0 inches
Displacement at mean draft.....	14,000 tons
Deadweight capacity	10,050 tons
Contract speed	10.5 knots
Speed on trial over measured mile.....	11.24 knots

The hull is constructed on the Isherwood system with a long poop and a short bridge and forecastle with connecting gangways. Fuel bunkers are arranged abreast of the machinery space on the tank deck aft and there are ten main tanks for oil fuel.

MAIN ENGINES

Two Vickers six cylinder four cycle, solid injection motors are installed aft, each developing normally 1,250 brake horse-

power at 118 revolutions per minute and having cylinders $24\frac{1}{2}$ inches diameter and 39 inches stroke.

Heavy cast iron columns are employed for the framing, representing a modified submarine trestle design with columns over the main bearing, the columns being continuous athwartships, although relatively thin between the front and back. Within these hollow columns are long steel tie-rods and the cylinders are separately cast and bolted together.

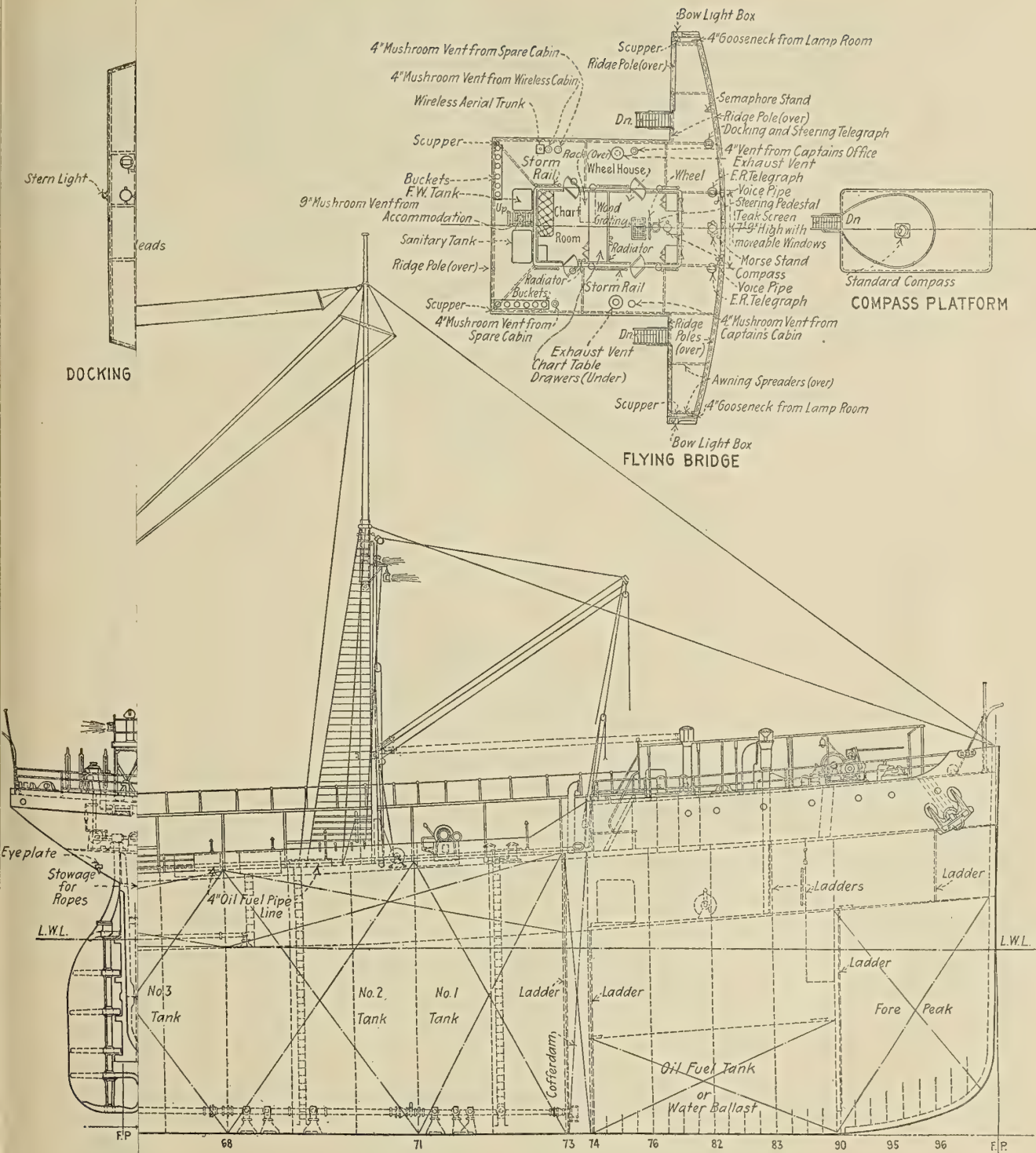
The liners and cylinder covers, which are separate, are of special cast iron, and a feature of note is the provision of diaphragm plates under the cylinders to prevent waste of lubricating oil. The liners are free to expand downwards.

FUEL OIL SYSTEM

The engines are fitted with the Vickers patent system of solid injection of fuel oil which entirely dispenses with the use of compressed air for fuel injection purposes. The principle lies in forcing fuel oil at about 4,000 pounds per square inch into the cylinder through a special type of valve in the cylinder cover. The fuel is supplied under this pressure by means of a small battery of four pumps discharging to a common rail with branches leading to each cylinder.

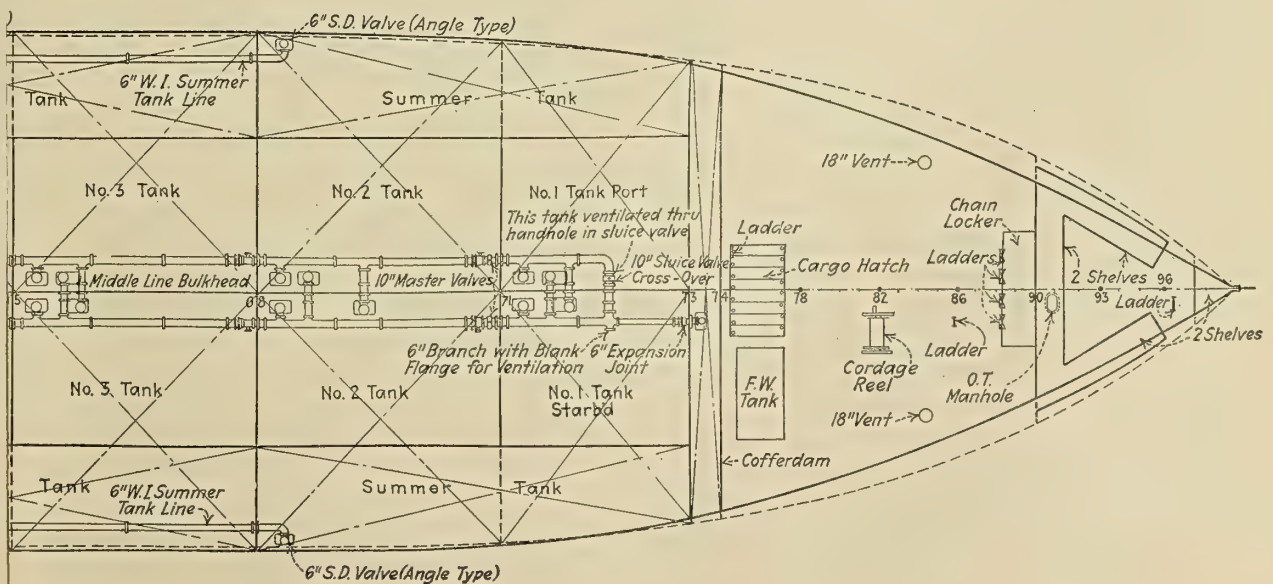
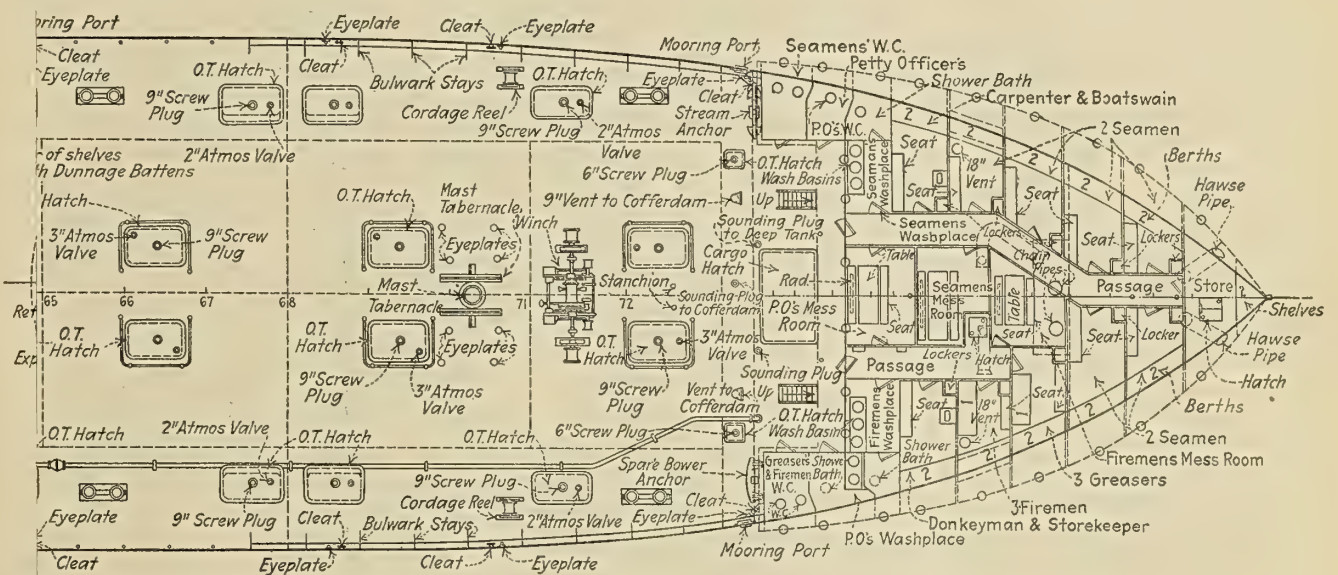
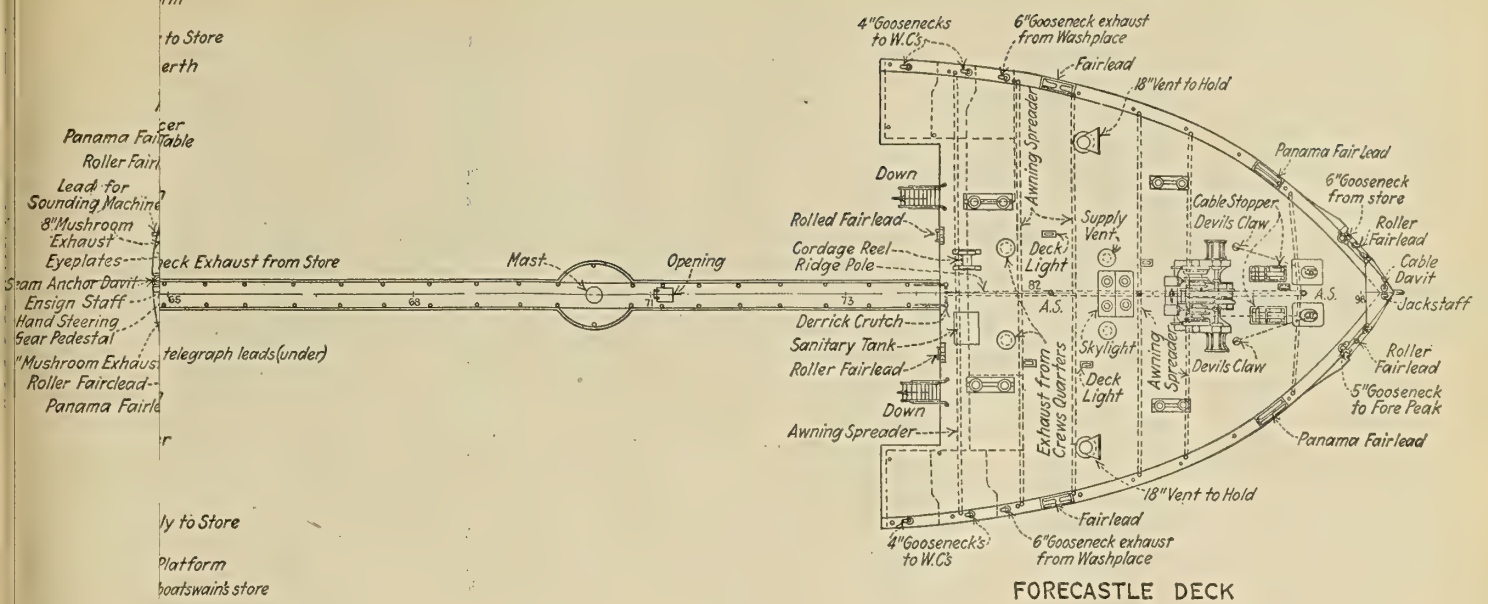


Fig. 1.—10,000-Ton Motor Tanker *Narragansett* on Her Trial Trip



; Designed Speed, 10.5 Knots

Fig. 2.—Profile and Bridge Deck Plans: Length Between Perpendiculars, 425 Feet; Beam, Molded, 56 Feet 8 Inches; Depth to Upper Deck, Molded, 33 Feet; Mean Draft, 26 Feet; Deadweight Capacity, 10,050 Tons; Designed Speed, 10.5 Knots



THE MOTORSHIP NARRAGANSETT

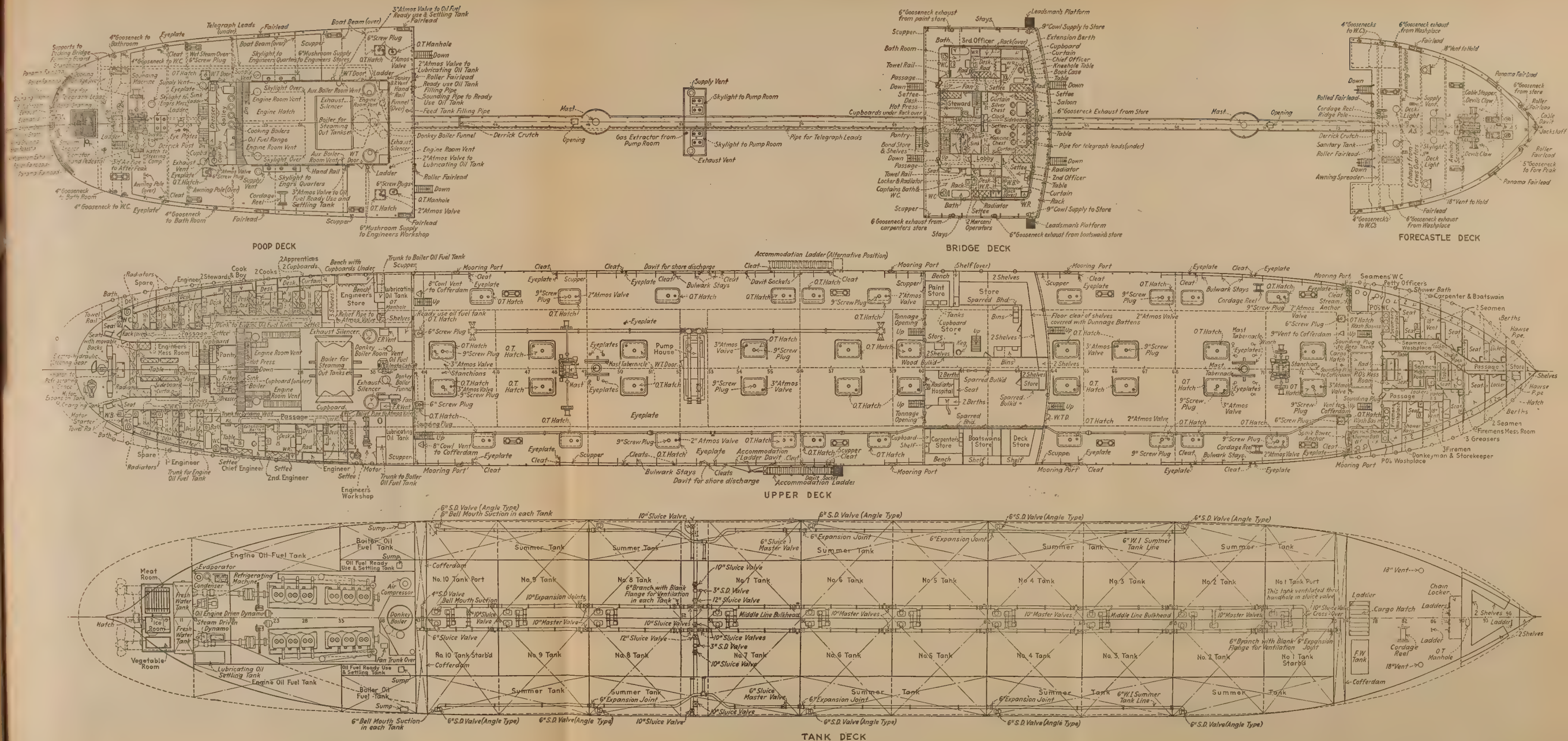
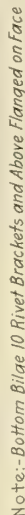


Fig. 3.—Deck Plans

*Note:- Buttlap to be scarphed where practicable in way of
pedae landings & stiffeners so as to avoid fitting slips.*



BULKHEAD NO. 56. - LOOKING AFT.

Fig. 4.—Bulkhead Details

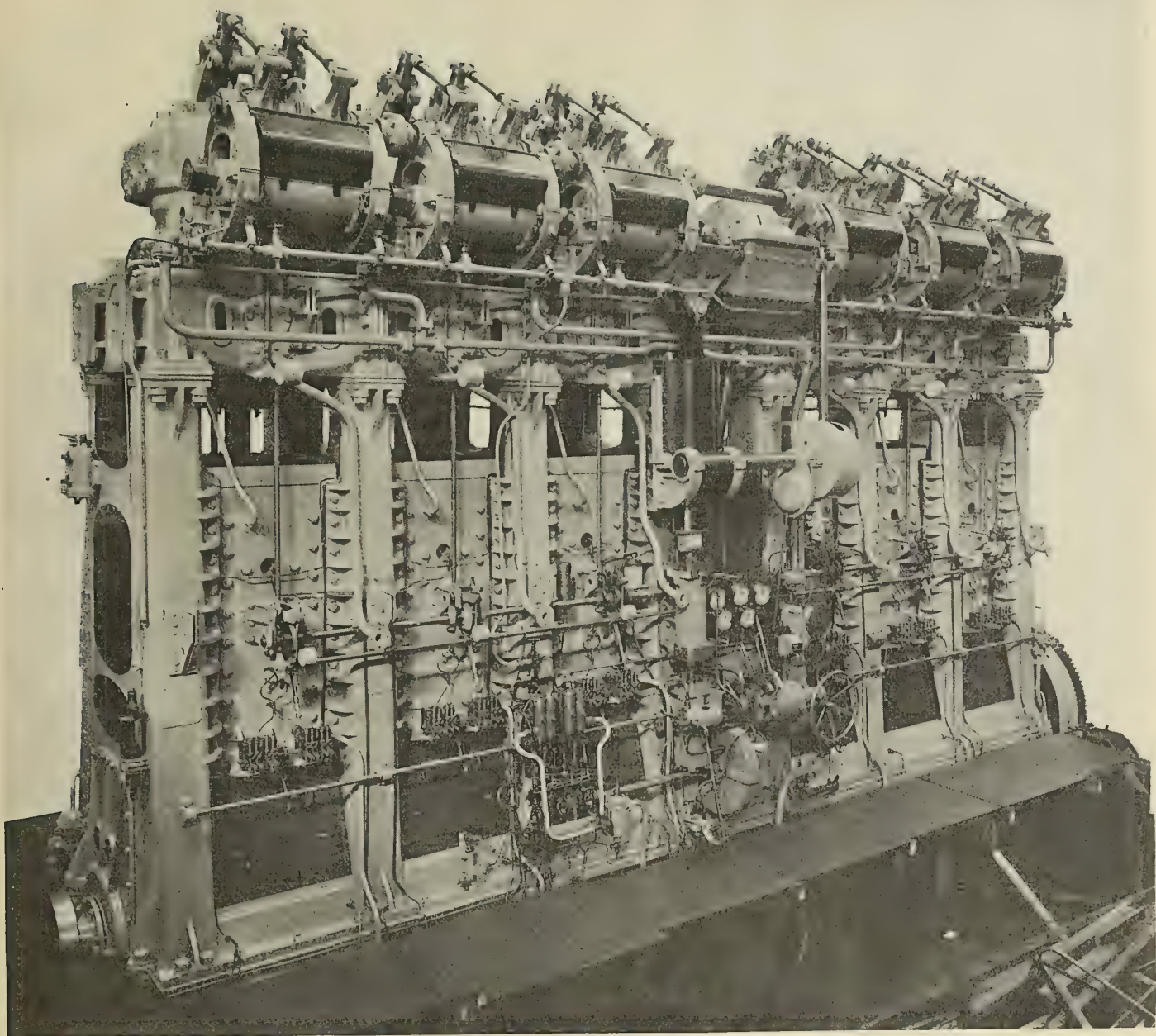


Fig. 6—Vickers Six-Cylinder Solid Injection Motor. Two of These Motors, Developing 1,250 Brake-Horsepower Each, Are Used to Drive the *Narragansett*

AUXILIARIES

The bulk of the auxiliary machinery is steam driven. For the provision of the steam there is a Cochran boiler at the forward end of the engine room, while another boiler is situated at a higher level, both of these being oil fired. When at sea the small donkey boiler only is required, being sufficient for ordinary heating purposes and for the auxiliary steam plant such as the dynamo or compressor.

The steam-driven auxiliaries in the engine room comprise two Brotherhood compressors for providing starting air, together with two sets of fire and bilge pumps.

ELECTRIC PLANT

At the after end of the engine room is the electrical plant comprising a steam engine driving a dynamo and a Vickers Petter semi-Diesel motor of 38 horsepower also driving a dynamo. These supply electric power for lighting and steering and also for one or two pumps.

The steering gear is of the Vickers variable speed gear type operating on the electric-hydraulic principle.

There are two steam-driven cargo pumps having a capacity of 200 tons per hour each. The capstan and the two 7-inch by 10-inch winches forward and one 8-inch by 12-inch winch aft are also steam driven.

The galley, designed to cook for fifty people, is oil fired.

PERFORMANCE OF THE VESSEL

The performance of the vessel on service has been in every way satisfactory and the following particulars of the run back from New Orleans to Liverpool, July, 1920, on maiden voyage, show the fuel consumption, etc., on a long sea voyage:

Total distance	4,528 nautical miles
Running time (approximately).....	17 days
Average speed (actual).....	11.1 knots
Mean revolutions per minute (as designed).....	118
Engine fuel used per day.....	9.61 tons
Boiler fuel used per day.....	2.13 tons
Total fuel consumption per day.....	11.74 tons

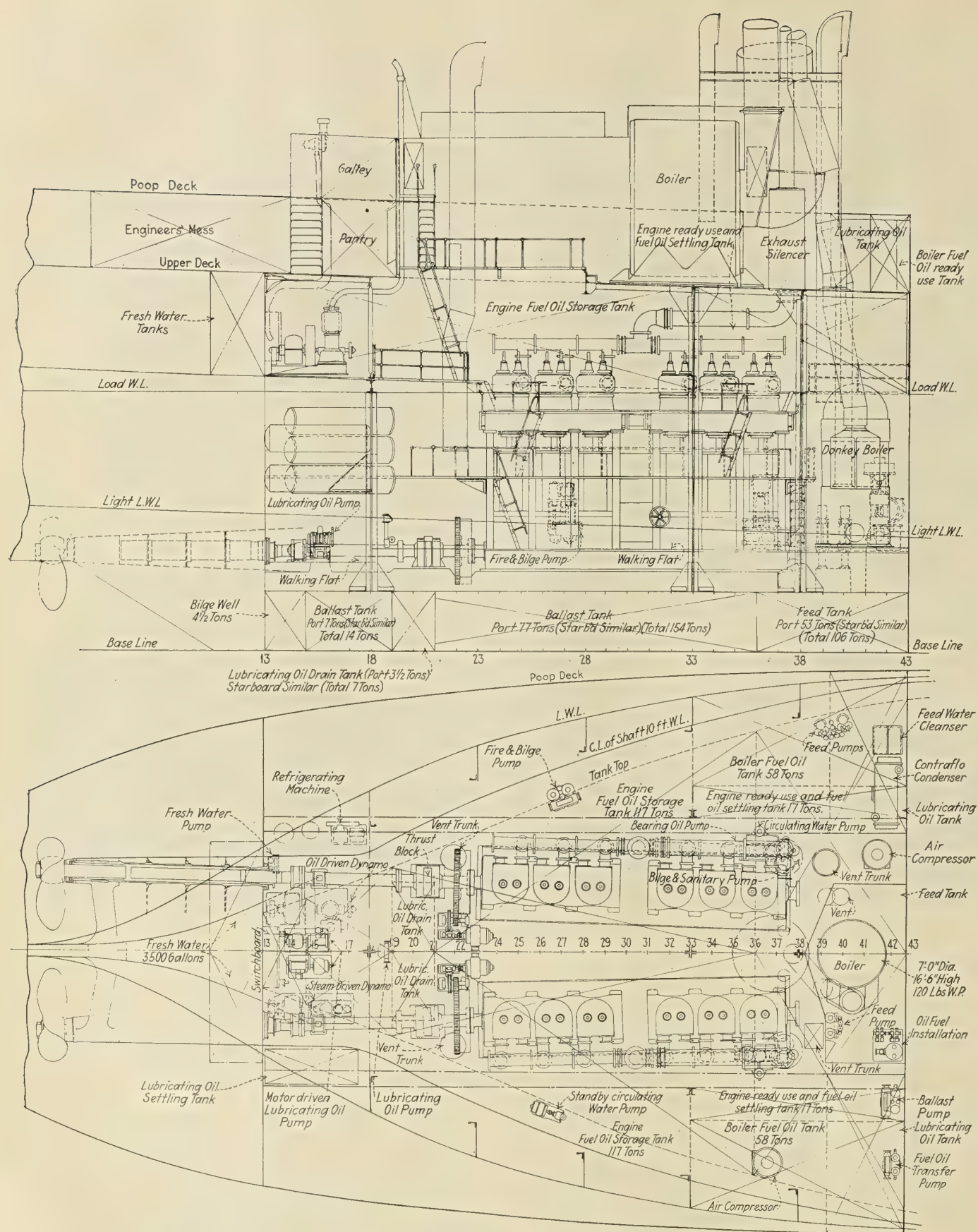


Fig. 7.—Plan and Elevation of Machinery Space

According to information received from owners regarding similar oil fired steam vessels, the average speed is 10.25 knots and the daily consumption of oil 35 tons, while the

daily consumption of fuel in a coal fired steam tanker very slightly larger than the *Narragansett* is 55 tons at 9.8 knots speed.

Sixteenth Annual Motorboat Show Successful

THE National Association of Engine and Boat Manufacturers held its sixteenth annual exhibition at the Grand Central Palace, New York, December 10 to 18. Exhibits were presented by 113 members of the association which included nearly every type of high and low powered motor boats, engines for speed boats, heavy duty motors, and marine accessories of all kinds that might in any way be applied to the needs of commercial and pleasure craft. Developments in the field have been rapid during the past two years, and the latest hull designs of various builders were a special feature of the show. On the main floor of the exhibit about twenty-five boats ranging from 10-foot dories to 60-foot cruisers were arranged with ladders and platforms, so that visitors

might climb aboard and investigate the arrangements and equipment.

The *Rainbow*, winner of the first race for the Fisher trophy at Detroit last year, and the *Tarpon*, especially built for the second trophy event to be staged at Miami, Fla., in February, were exhibited side by side. Together with racing motors and light weight high powered engines for fast pleasure craft, many of the exhibitors presented heavy duty gasoline, kerosene and heavy oil engines for inspection.

The Mianus Motor Works, Stamford, Conn., exhibited several improved Diesel heavy oil engines, including a 60-horsepower, 4 cylinder model and a 30-horsepower, 2 cylinder engine with smaller types of 15 horsepower and $7\frac{1}{2}$ horsepower.

The Winton Engine Works, Cleveland, Ohio, exhibit contained three complete units, model W-5, a 125-horsepower

engine, model W-2, a generator set, and model 85 water and air pump. The marine motor has six 8-inch cylinders and a stroke of 11 inches, a crank shaft diameter of $3\frac{1}{2}$ inches, main end bearing $3\frac{1}{2}$ inches by 9 inches, interior bearings $3\frac{1}{2}$ inches by $5\frac{1}{2}$ inches, connecting rod bearing $3\frac{1}{2}$ inches by $4\frac{1}{8}$ inches, a speed range of 100 to 450 revolutions per minute and a weight of 10,000 pounds. The generating set consists of a six cylinder 3-inch by 4-inch engine driving a $7\frac{1}{2}$ -kilowatt Imperial generator at 1,200 revolutions per minute, which delivers current at 110 volts.

The Dodge Sales & Engineering Company, New York City, showed a 4 cylinder 50-horsepower heavy oil engine.

Buffalo heavy duty oil engines were also shown.

The Wolverine Motor Works, Bridgeport, Conn., exhibited a 6 cylinder 11-inch diameter by 15-inch stroke 200-horsepower outfit and a 3 cylinder 42-horsepower $8\frac{1}{2}$ -inch by 9-inch engine. Both of these engines are designed to burn gasoline and equipped with high tension ignition systems.

The Van Blerck exhibit consisted of 4, 6 and 8 cylinder, high power, speed boat engines and a 4 cylinder, heavy duty commercial engine. All of the marine engines built by this company are equipped with a special fuelizer which makes it possible to control the engines from low to high speed and full load without back firing.

For large motor yachts the New London Ship & Engine Company, Groton, Conn., had developed the Nelseco Diesel engine, which can be built in units from 120 horsepower to 3,400 horsepower.

One of the largest engine exhibits at the show was that of Palmer Brothers Engines, Inc., of Cos Cob, Conn., which included heavy duty engines of 18, 35, 60 and 80 horsepower. These engines develop their rating at 300 to 400 revolutions per minute. In all the 4 cycle models, except the single cylinder, a multiple disk reverse gear is mounted on the base and the single cylinder size may be so equipped if desired.

The New York Yacht, Launch & Engine Company, Morris Heights, New York, exhibited a 4 cylinder, 40-50 horsepower and a 6 cylinder 65-75 horsepower twentieth century motor.

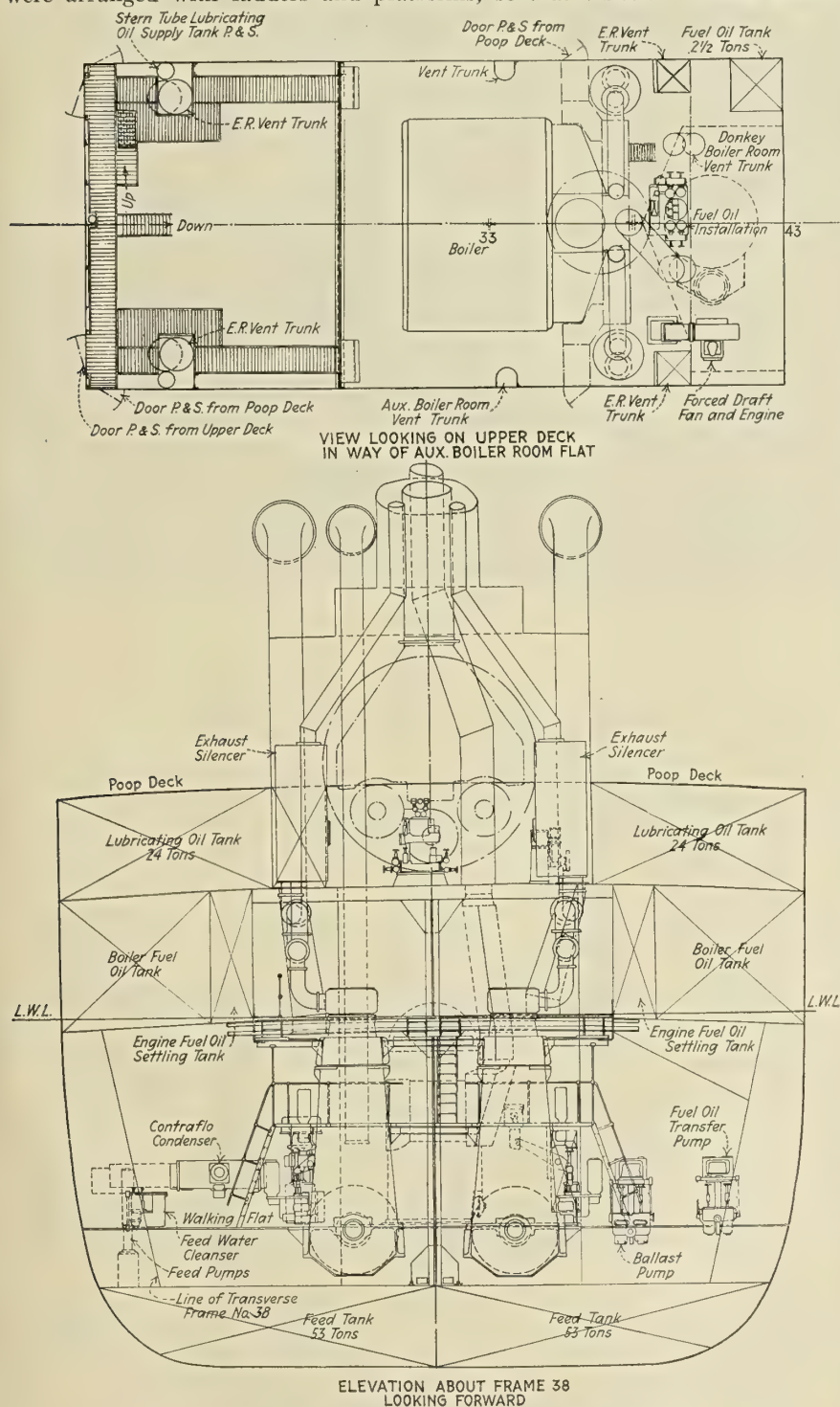


Fig. 8.—Section Through Engine Room

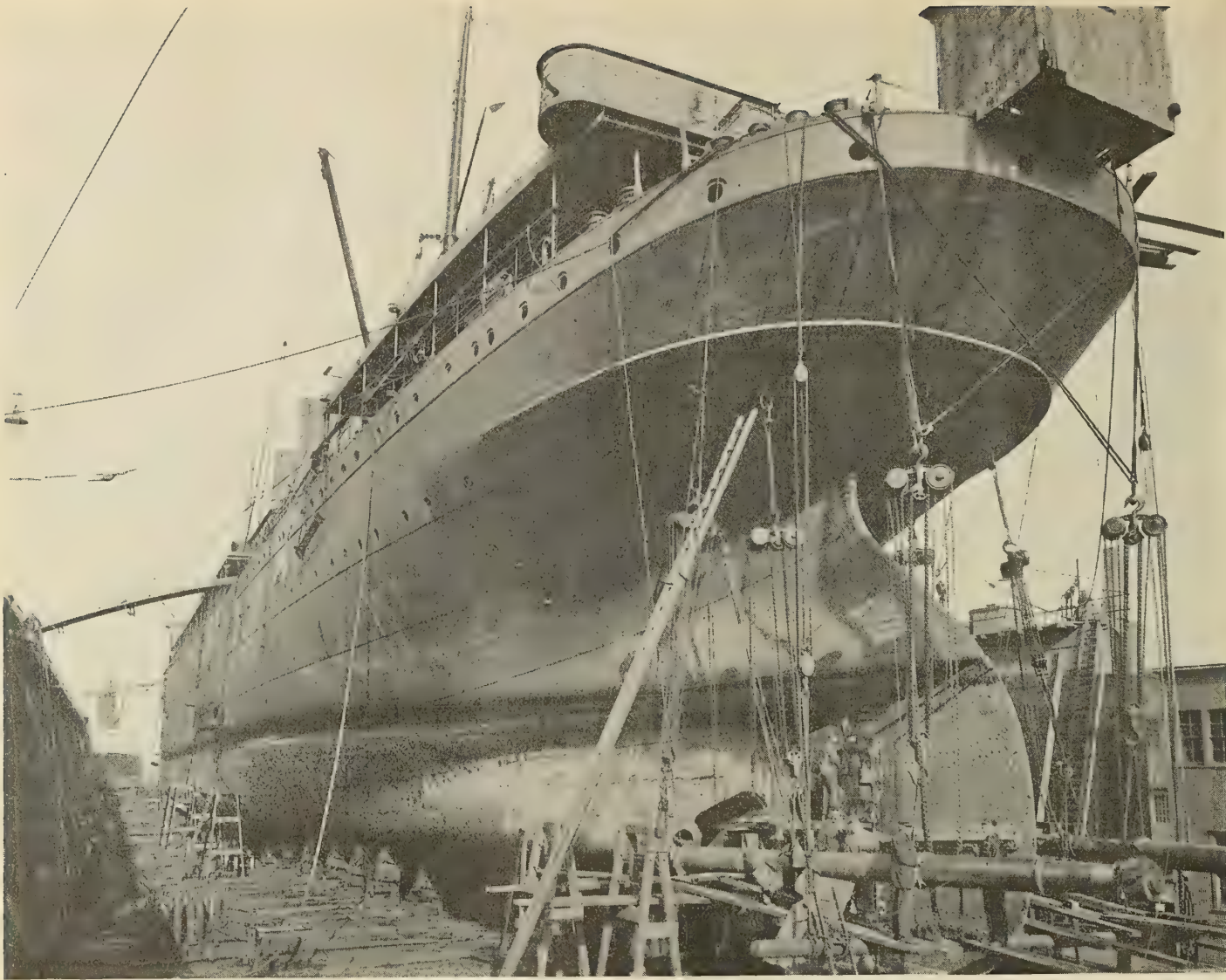


Fig. 1.—Fitting Propeller Shafting to the *Mount Clay* in Morse Dry Dock

Passenger Steamship *Mount Clay*

Reconversion of German Steamship *DeKalb* into Steerage Vessel with Large and Attractive Accommodations

BY JAMES A. KELLEY*

ONE of the largest reconversion contracts to be furnished in the United States up to the present time is the German built steamer *Mount Clay*, ex-*DeKalb*. This vessel was formerly the *Prinz Eitel Friedrich* and was built at the Vulcan Works at Stettin, Germany, in 1904. Before the United States declared war against Germany this vessel had a notorious career and featured in many daring exploits.

The vessel was taken over by the United States Government at the beginning of the war and did creditable service as an army transport.

The following are the dimensions of the vessel:

Length overall, 506 feet 6 inches; length between perpendiculars, 489 feet 2 inches; breadth, molded, 34 feet 10 1/16 inches; depth, molded, 34 feet 10 7/16 inches.

She is built on the transverse system, with deep channel frames with webs and stringers. The double bottom has a depth of 48 inches and extends the full length of the vessel. When built, the vessel was classed to the highest rating then given by the Germanischer Lloyds.

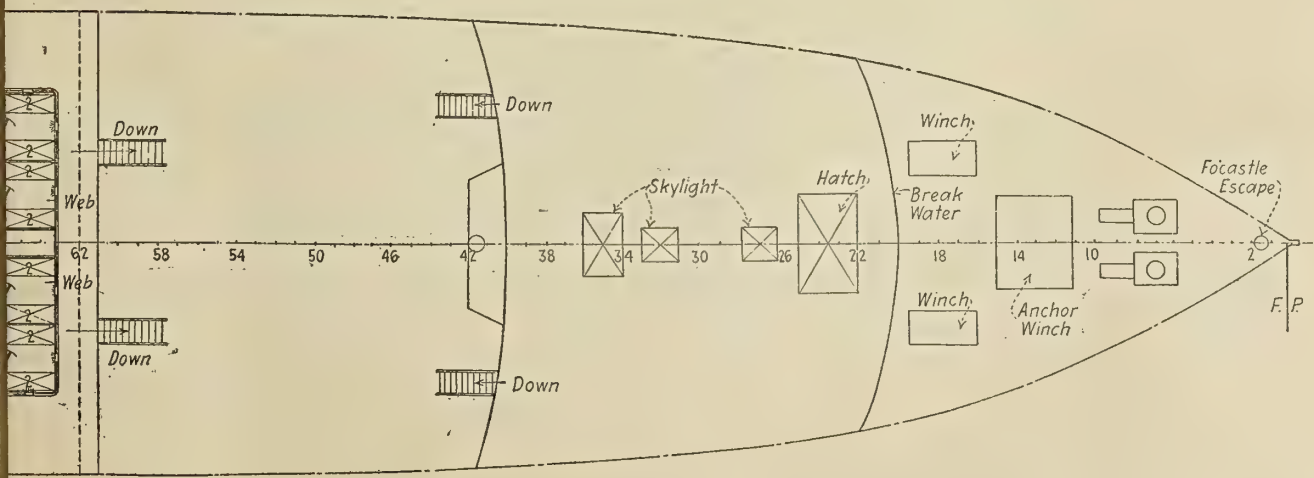
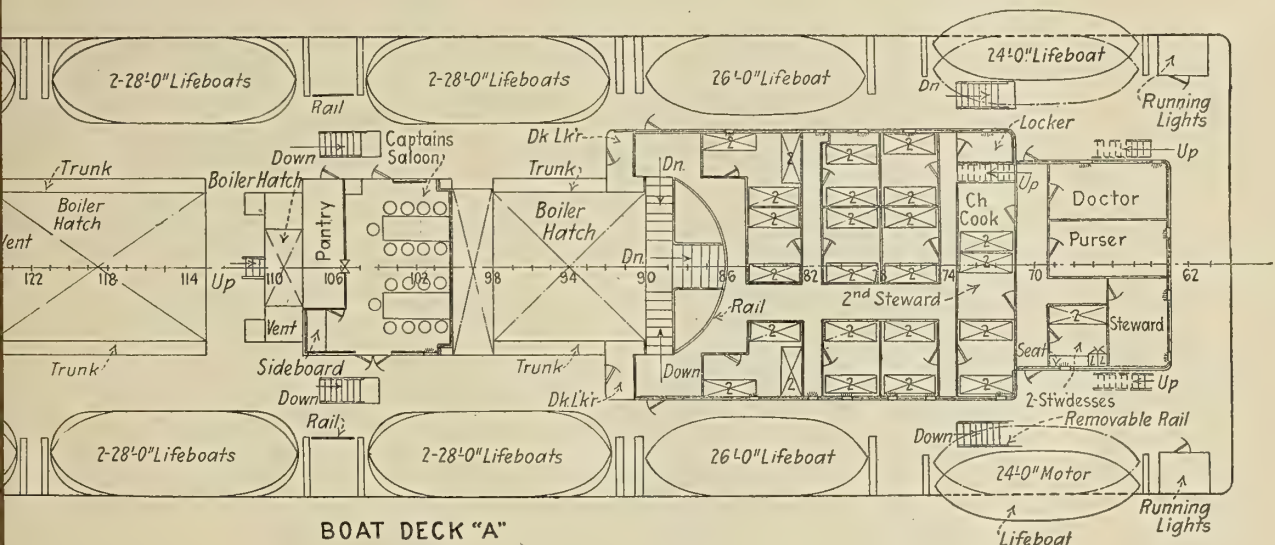
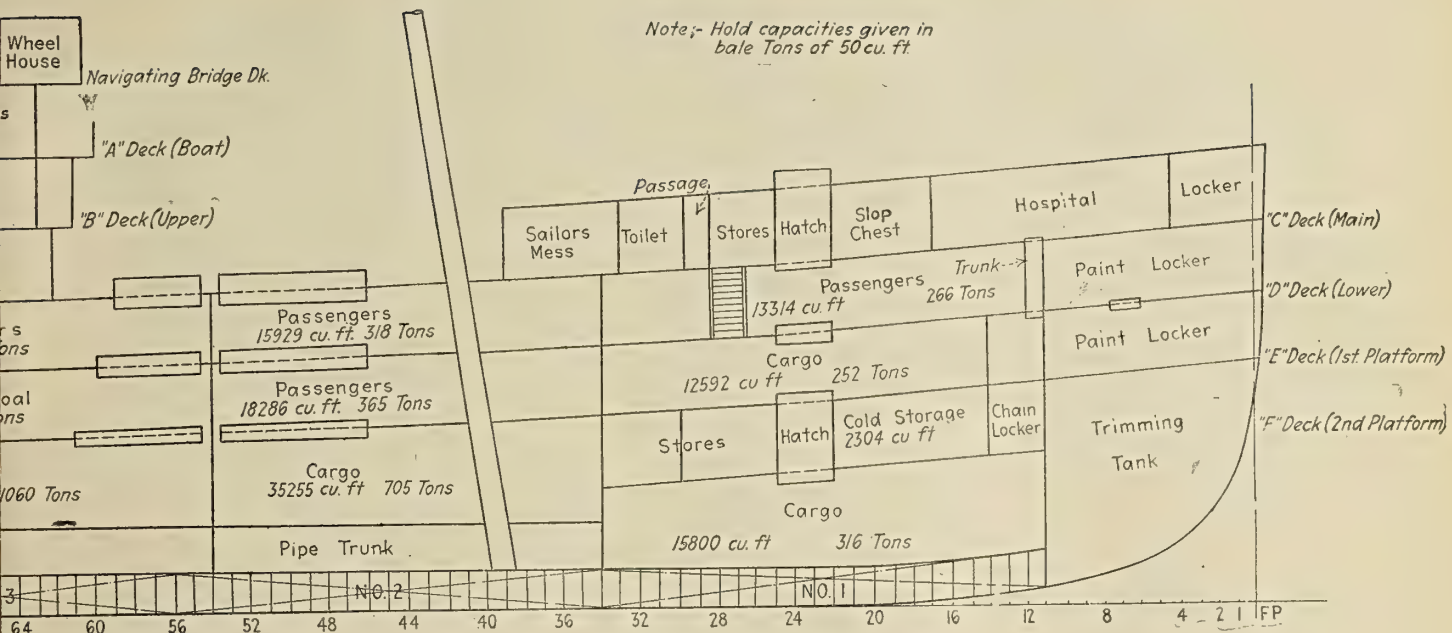
When the vessel arrived at the yard of the Morse Dry Dock & Repair Company she had been completely gutted by fire which occurred in the Hudson River at Spuyten Duyvil. The owners of the ship decided to convert her into a first class steerage vessel to carry the largest number of persons possible and at the same time to give the passengers larger and more attractive public rooms than are customary on this type of ship.

The navigating officers' wheel house and chart room are situated on the navigation bridge deck, the only deck which the steerage passengers will not be allowed to use. On this deck also are three special staterooms for use of various ship company's officers. These rooms are fitted up in elaborate style.

On the top deck is a large passenger promenade. The deck house contains large rooms for doctor, purser, steward and stewardess. The remainder of the deck house is given over to steerage passengers' use, containing four and six berths each. Between the two boiler casings will be found the cap-

(Continued on page 78.)

* Naval architect, Morse Dry Dock and Repair Company, Brooklyn, N. Y



PASSENGER STEAMSHIP MOUNT CLAY

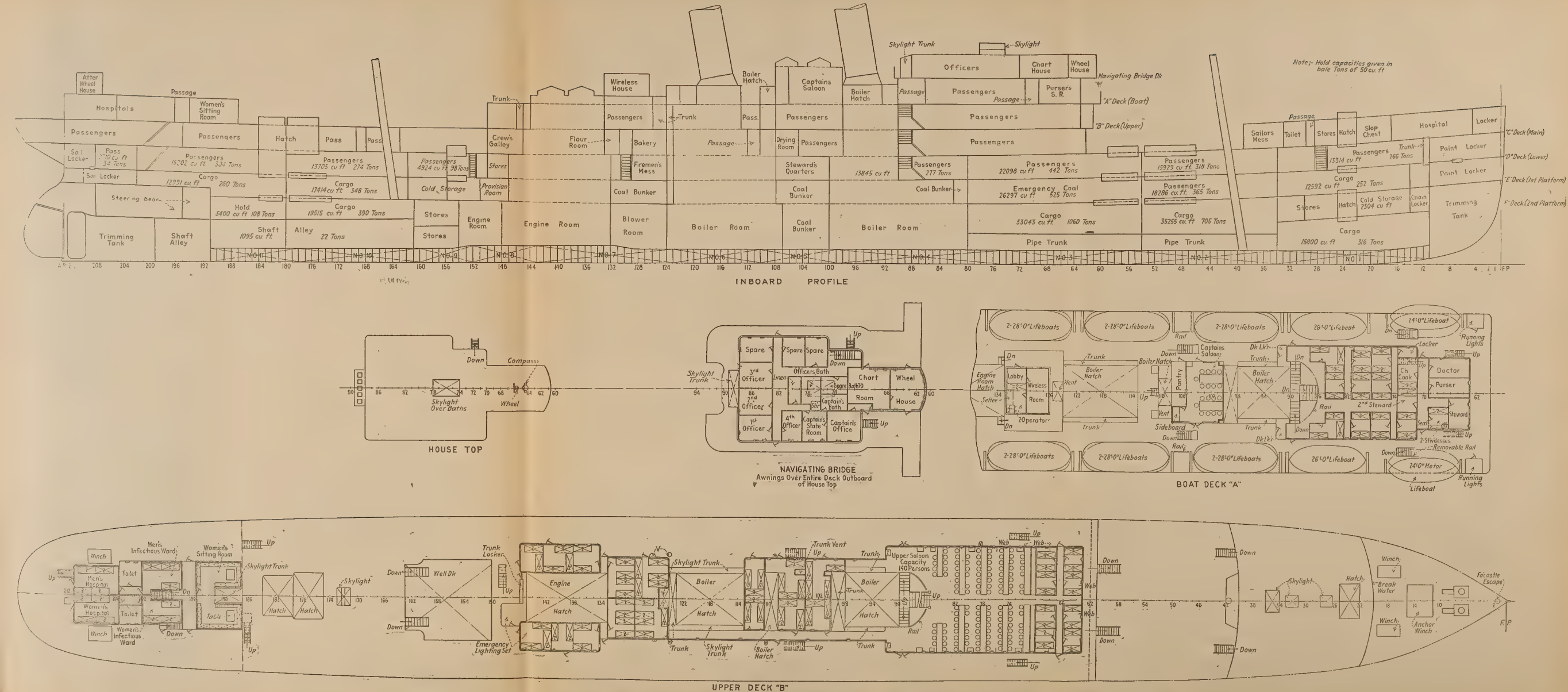
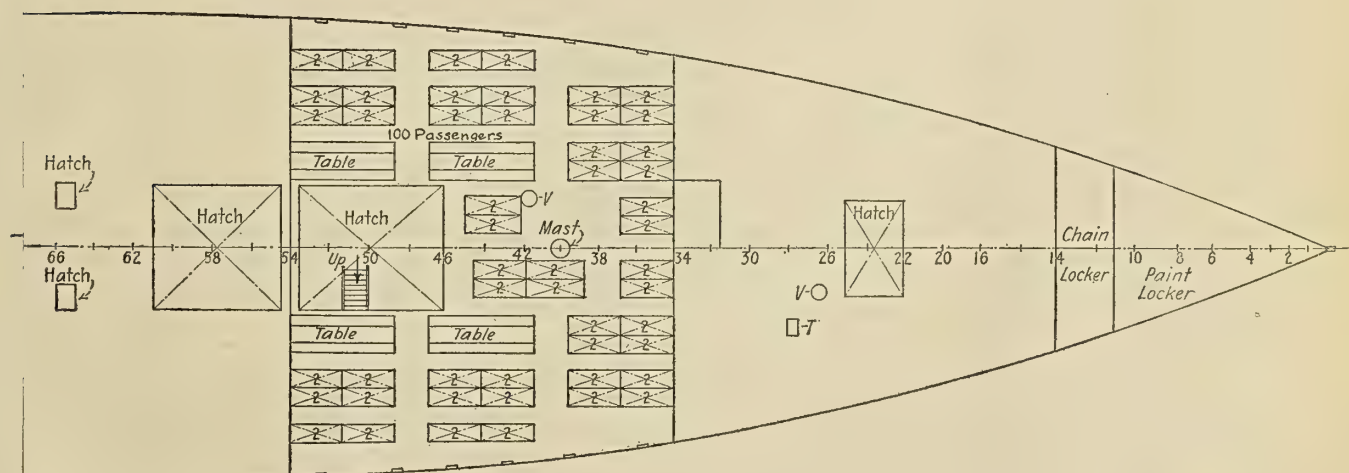
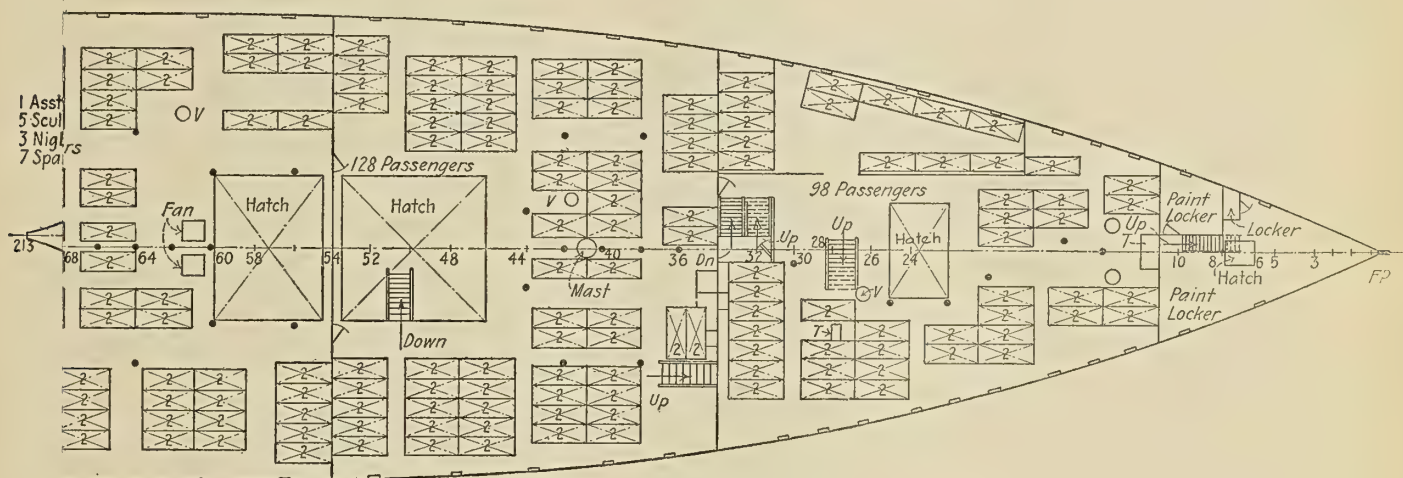
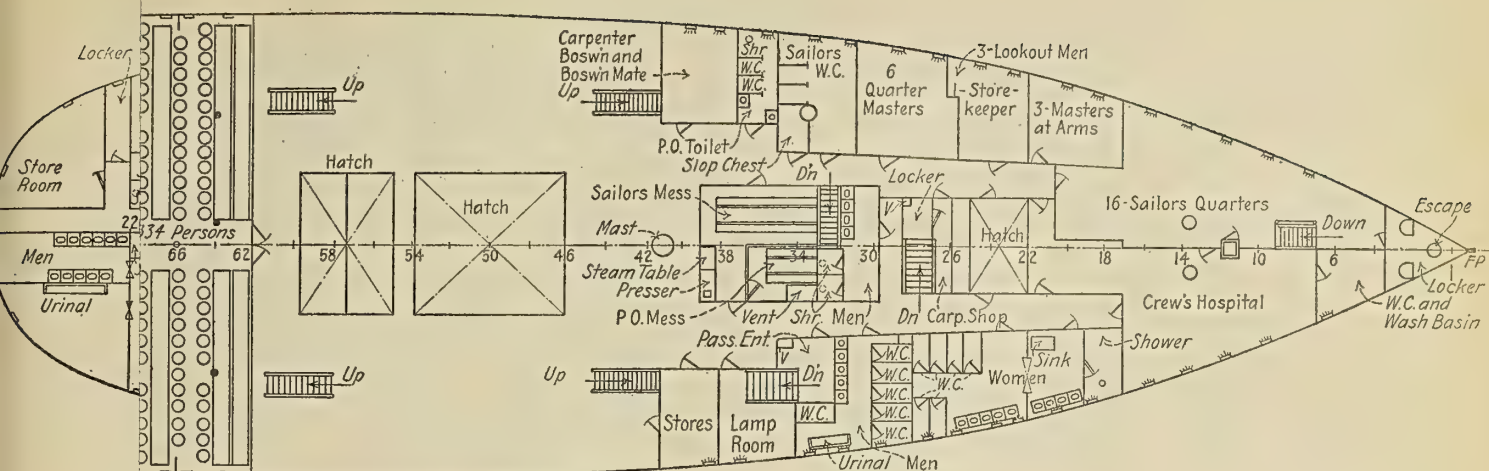
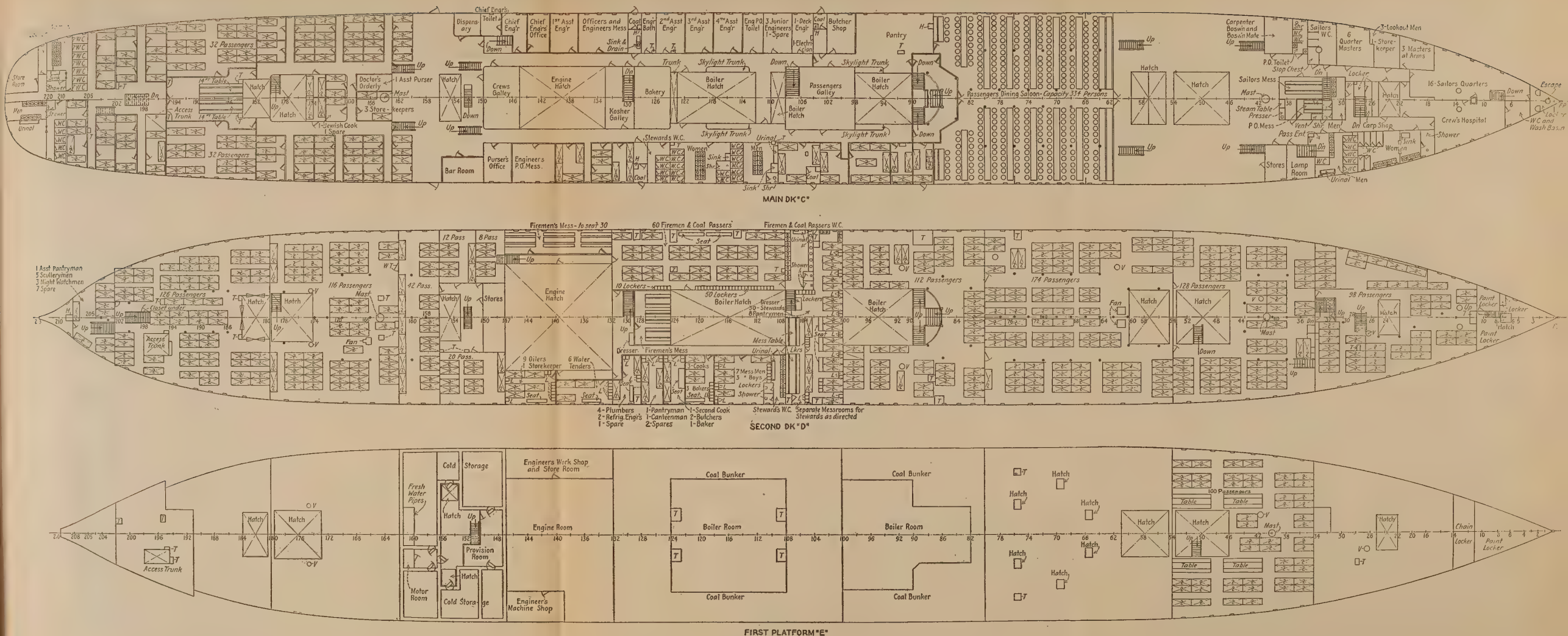


Fig 2.—Inboard Profile and Deck Plans of S. S. Mount Clay: Length Overall, 506 Feet 6 Inches; Length Between Perpendiculars, 489 Feet 2 Inches; Beam, Molded, 34 Feet 10 1/16 Inches; Depth, Molded, 34 Feet 10 7/16 Inches



PASSENGER STEAMSHIP MOUNT CLAY



FIRST PLATFORM "E"

Fig. 3.—Deck Plans

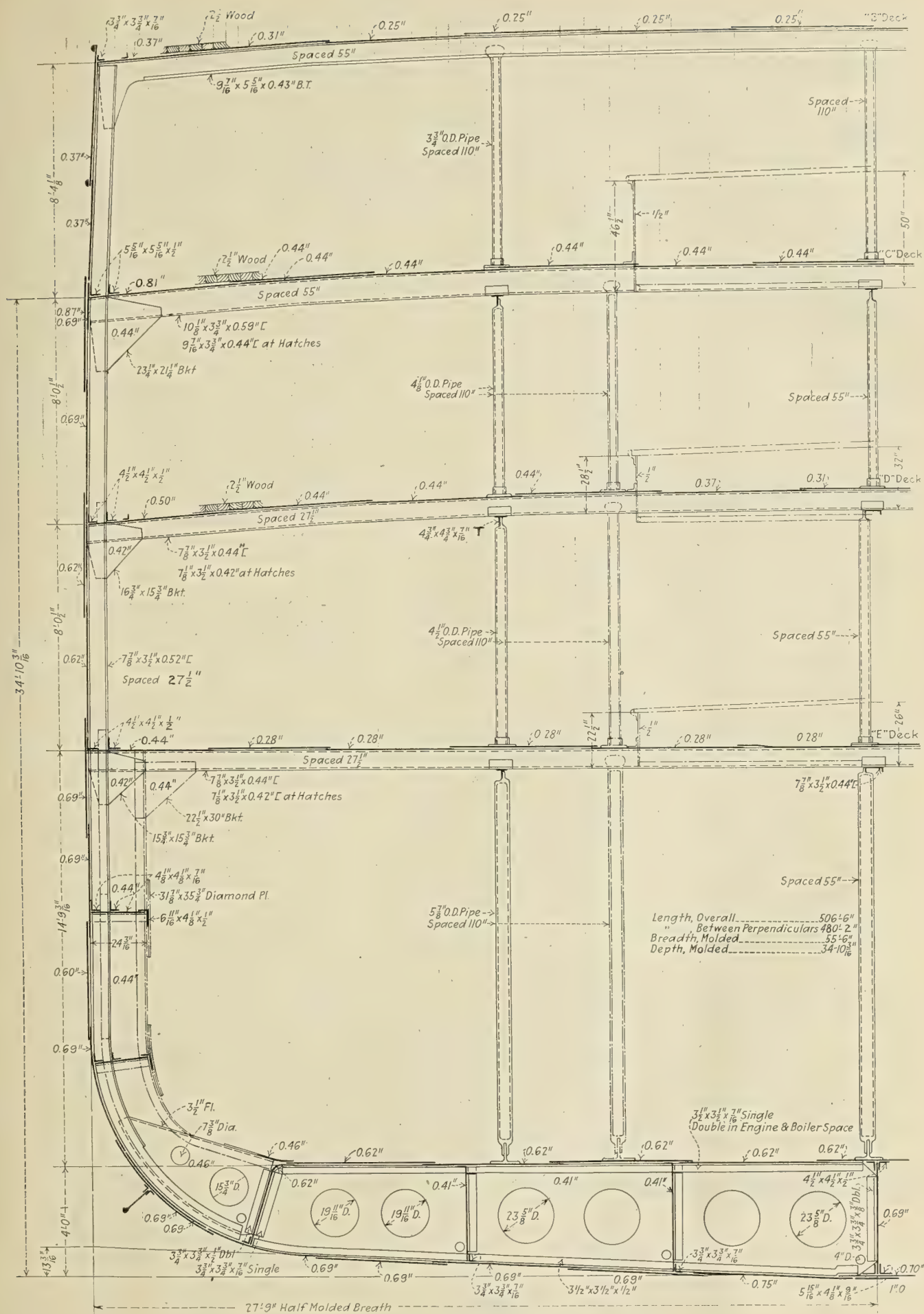


Fig. 4.—Midship Section

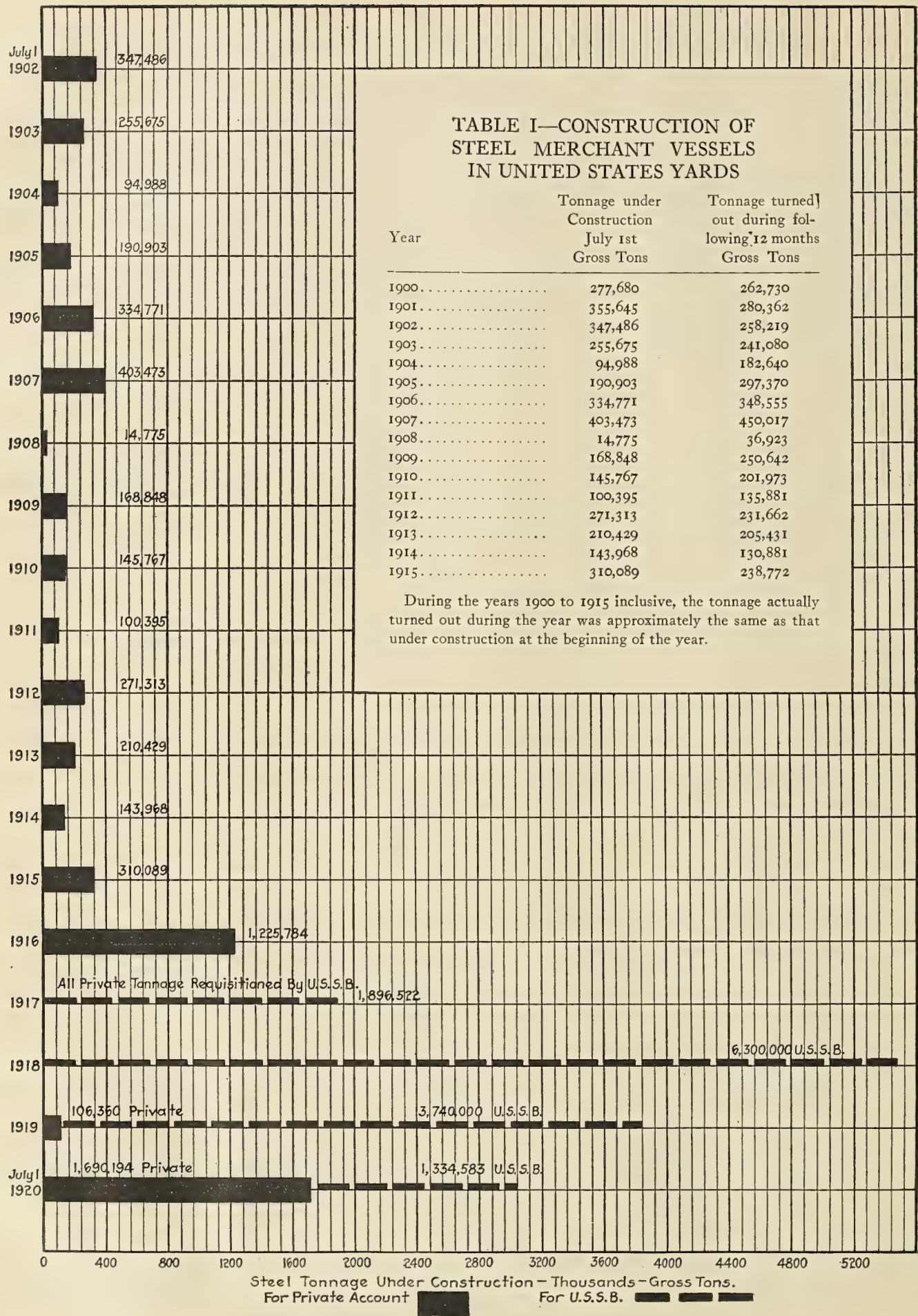


Fig. 1.—Steel Merchant Tonnage Under Construction in United States Shipyards

American Shipbuilding—Present and Future

Output of Merchant Tonnage Has Increased Six-Fold— Repair Yards Active—Large Naval Programme Under Way

THE tremendous shipbuilding programme initiated in the United States as a war-time emergency measure is now practically completed. At the height of this building programme the United States reached a production in ship tonnage far greater than any other country has ever attained, or ever will attain.

But in order to take advantage of the shipbuilding facilities which could be made most quickly available, the emergency programme necessarily contained a large percentage of wooden ships and of small steel cargo vessels. While the construction of such ships was fully justified by the emergency, their relatively small commercial value will eliminate them from any construction under normal conditions. Moreover, even in the construction of large steel vessels of the best type, yards were utilized and methods were employed which would never have been used for building ships on a strictly commercial basis.

In determining today the relative position of shipbuilding as a sound, healthy industry, it is essential, therefore, to disregard largely the war-time programme.

SHIPS BUILDING FOR PRIVATE ACCOUNT

The sound growth of the shipbuilding industry is dependent upon construction for private interests, inasmuch as such ships are built to fill the normal needs of a particular trade. In the spring of 1919 shipyards were again permitted to accept orders for private account, and by July 1, 1919, contracts had been let for over 100,000 gross tons of steel ships. By July 1, 1920, the tonnage under construction or contracted for, for private account, had increased to approximately 1,700,000 gross tons.

Only by comparison with pre-war construction for private interests can this volume of shipbuilding be appreciated. Fig. 1 shows graphically the tremendous increase in private construction during the past few years.

SHIPBUILDING A LEADING INDUSTRY

A comparison of shipbuilding with our other national industries gives an idea of its enormous expansion. In 1914 the total value of the output of the industries of iron and steel and their products was \$3,223,144,000, of which shipbuilding was approximately 2¾ percent. The present estimated value of the annual output of the iron and steel industries is \$6,500,000,000, of which shipbuilding is approximately 15 percent.

In 1914 shipbuilding, with a total value of output of \$88,682,000, ranked fifty-eighth among the industries of the United States. The construction now under way places shipbuilding in about fifteenth position, surpassing such industries as leather, furniture, chemicals, paper and wood pulp, agricultural implements, silk and sugar.

OUTPUT OF SHIPYARDS INCREASED SIX-FOLD

The steel merchant tonnage now under construction for private account (approximately 1,500,000 gross tons) is over six times the average pre-war output of steel merchant

vessels (235,000 gross tons annually), and is approximately three and one-half times our best annual output prior to the war (450,017 gross tons of steel ships in 1908).

OVER 2,000,000 TONS NOW UNDER CONSTRUCTION

On September 1, 1920, there were under construction 2,463,314 gross tons of steel merchant vessels. Of these, 1,438,498 gross tons were for private account and 1,024,816 gross tons were for the United States Shipping Board. On September 15, 1920, there were under construction for private account steel vessels aggregating 1,449,859 gross tons. This was practically the same as the private account tonnage under construction on July 1, 1920, new orders having replaced the tonnage delivered. This indicates that shipbuilding should continue for the next year or two at a minimum of approximately 1,500,000 gross tons annually.

Statistics on shipbuilding for the years 1900 to 1915 inclusive show that the total tonnage of steel merchant vessels under construction at the beginning of each fiscal year was practically the same as that turned out during that year. Inasmuch as our shipyards are again working under normal conditions, we may expect to deliver the tonnage now building within the next twelve months, and this figure, rather than the tonnage built during the past year, may be used in estimating production during 1921.

INCREASED NAVAL CONSTRUCTION

Another important phase of the shipbuilding industry is the current construction for the United States Navy and other Government departments. At present the vessels being built for the Navy aggregate well over 1,000,000 tons displacement, a large percentage of which are being constructed in private yards. Present indications are that this programme will continue for the next two or three years.

GROWTH OF THE MERCHANT MARINE

The tonnage of our merchant marine has more than doubled during the past six years, and our present tonnage is over 16,000,000 gross tons, slightly less than one-third the total world tonnage. The tonnage now under construction will bring this total up to approximately 19,000,000 gross tons by July 1, 1921. Our foreign commerce has also increased enormously, and the percentage of our foreign commerce carried in American ships has increased in even greater proportion. In 1914 the proportion of American tonnage to the total tonnage entering and clearing United States ports was 26 percent, while during the first six months of 1920 this had jumped to 60 percent (see Fig. 2).

SHIP CONSTRUCTION REQUIRED FOR REPLACEMENT

That a minimum annual output of 1,500,000 gross tons of steel merchant vessels is a conservative estimate is borne out by the following: By July 1, 1921, our merchant marine will aggregate approximately 19,000,000 gross tons. Assuming

Merchant Marine Vital to National Prosperity

Our national prosperity during the past few years has been due largely to our foreign trade and our continued prosperity depends ultimately on foreign business. To maintain our connections with foreign buyers, so essential to our national prosperity, a large and efficient merchant marine with ample facilities for the building and repairing of vessels is absolutely necessary. Both the shipbuilding and shipping industries have taken a permanent place in America and will be maintained.

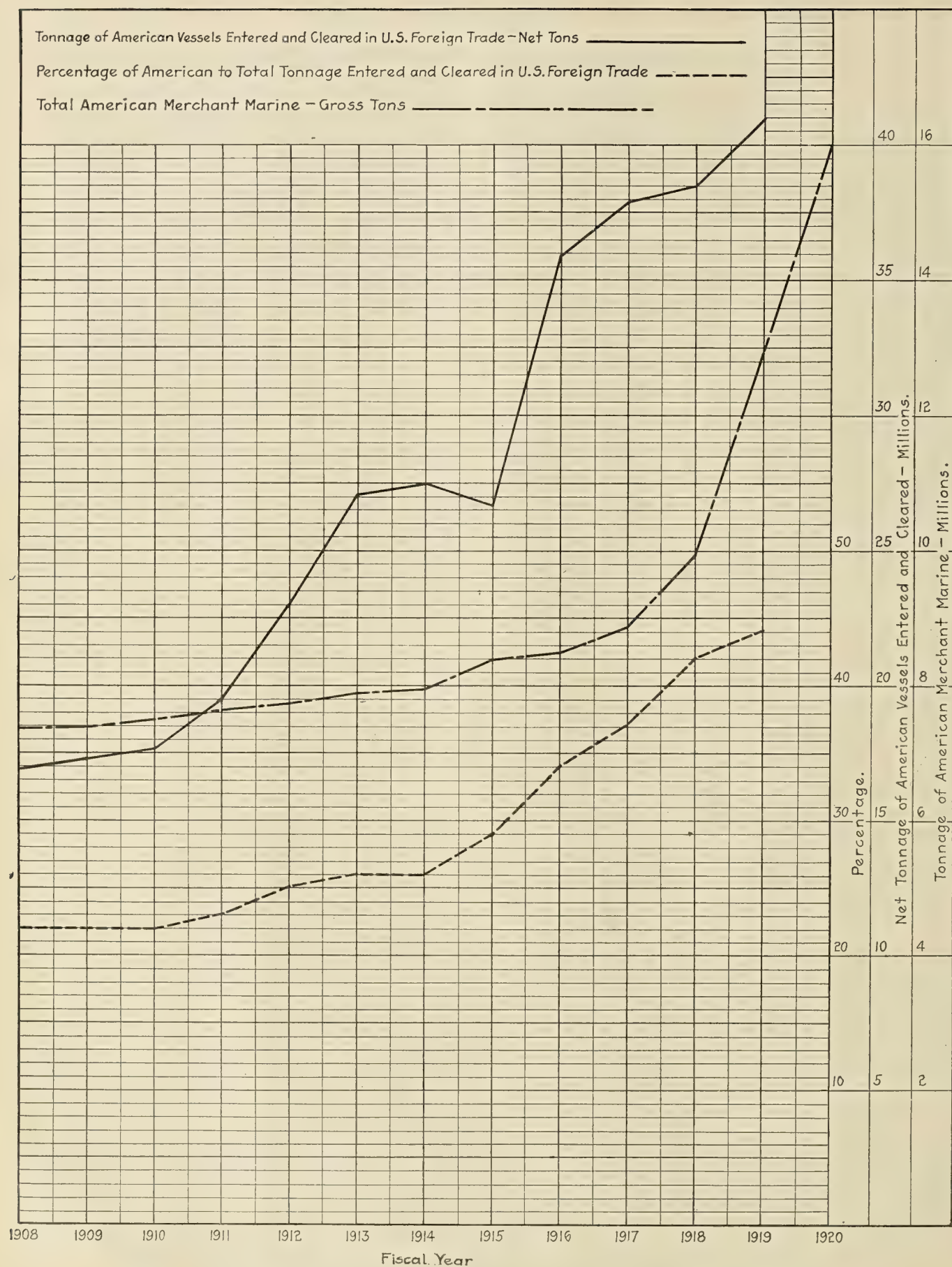


Fig. 2.—Expansion of the American Merchant Marine

the average life of a ship to be twenty years, there will be required annually for the *upkeep only* of our merchant fleet 5 percent of this tonnage, or approximately 950,000 gross tons. Actual replacements will undoubtedly be much larger, inasmuch as a large part of our present merchant marine is composed of wooden ships.

REPAIR YARDS ACTIVE

The rapid growth of our merchant fleet has brought a large volume of repair work to our ship repair plants. In a few years, when the new ships of our present merchant marine begin to show signs of wear, our present repair facilities will be inadequate for this work, and we can then look for considerable expansion in the ship repair industry.

THE JONES BILL

That it is the firm intention of the American people to maintain the advantage in shipbuilding and ship operating gained during the past few years is evidenced by recent legislative acts, the principal one being the Jones Bill. Among its provisions are the establishment of steamship lines by the United States Shipping Board, the sale of Shipping Board ships to private owners on easy terms, the establishment of a fund of \$25,000,000 annually for five years to be loaned for the construction of new vessels in United States yards, and the remission of excess profits taxes to the ship operating companies, provided they are used for the construction of new vessels in United States yards. Since the passage of this bill

in June, 1920, contracts have been let for approximately 250,000 gross tons of steel ships to be built under its provisions.

Continued legislation favorable to shipping is assured by the attitude of the incoming administration.

PROSPERITY ASSURED DURING 1921 AND LATER

The orders for merchant vessels already placed despite present high costs assure the prosperity of the shipbuilding industry during 1921.

All present indications are that the American shipbuilding industry will enjoy still greater prosperity in future years. Reconstruction in Europe has hardly begun and European manufacturers are not able to meet domestic demands, to say nothing of foreign orders. When foreign exchange returns to a normal basis the resultant demand for American goods throughout the world will lead to a vast increase in our foreign trade and an increased demand for ships. Still more ships will be needed to care for future foreign trade.

A considerable amount of new construction for foreign account can also be expected as soon as exchange rates become normal. Plans for a number of these ships have been drawn in this country. At present the greater part of our merchant fleet is composed of new vessels, some of which were built when *quantity* of tonnage was more urgent than *quality*. As these ships grow older an increase in repairs and more frequent replacements will be necessary in order to keep our merchant marine in shape to meet foreign competition.

TABLE I.—MERCHANT VESSELS BUILT IN THE UNITED STATES IN 1920

SHIPYARD	NUMBER OF SHIPS	TOTAL GROSS TONNAGE	TOTAL HORSEPOWER
American Bridge Company	45	35,000	
American International Shipbuilding Corporation	46	399,950	115,000
American Shipbuilding Company	63	255,900	75,600
Ames Shipbuilding Company	2	11,732	6,000
Baltimore Dry Docks & Shipbuilding Company	10	65,780	23,950
Bath Iron Works, Inc.	1	6,250	2,400
A. Bentley & Sons Company	2	7,500	2,800
Bethlehem Shipbuilding Corporation, Ltd.			
Fore River Plant	3	36,740	8,900
Harlan Plant	9	65,500	20,800
Moore Plant	7	14,270	3,880
Sparrows Plant	7	75,840	20,400
Union Plant (Potrero)	4	45,600	11,700
Union Plant (Alameda)	13	131,400	36,400
Bowker Shipyard	1	1,250	
Chance Marine Construction Company	3	492	1,350
Chickasaw Shipbuilding & Car Company	5	30,265	16,600
Francis Cobb Shipbuilding Company	1	2,500	
Consolidated Shipbuilding Corporation	1	310	200
Wm. Cramp & Sons Ship & Engine Building Company*	5	29,344	14,300
Crosby Navigation Company	1	1,000	
Cumberland Shipbuilding Company	1	1,138	
Oscar Daniels Company	6	57,000	16,800
Datchel-Carter Shipbuilding Company	2	400	900
M. M. Davis and Son, Inc.	10	10,000	
Doullut & Williams Shipbuilding Company	6	39,786	16,800
Downey Shipbuilding Corporation	2	8,438	5,000
Dravo Contracting Company (Engineering Works Department)	38	14,180	
Dubuque Boat & Boiler Works*	5	9,060	100
East Coast Ship Company	2	2,096	
Federal Shipbuilding Company	18	78,750	32,900
W. & A. Fletcher Company	(17 sets Parsons compound turbines total horsepower 49,500)		
Frye Flynn Company	1	1,156	
George A. Fuller Company	8	52,008	22,400
Globe Shipbuilding Company	4	10,000	4,800
Great Lakes Engineering Works	6	16,044	8,700
Greenport Basin & Construction Company	1	73	50
Groton Iron Works	3	18,648	8,400
Heldenfels Brothers	2	8,000	
Henderson Shipbuilding Company, Inc.	4	1,600	
H. R. James Company	1	92	125
Job Shipyard Corporation	2	1,035	
Johnson Iron Works, Dry Dock and Shipbuilding Company, Inc.	7	1,741	302
Johnson Shipyards Corporation	11	13,250	
Kyle & Purdy, Inc.	5	3,500	4,500
Leatham & Smith Towing & Wrecking Company	1	85	450
LeParmentier Shipbuilding Corporation	5	20,000	7,000
Long Beach Shipbuilding Company	6	37,200	12,150
Los Angeles Shipbuilding & Dry Dock Company	12	68,760	45,600
McCoy Bros. Incorporated	3	204	320
MacDonald Engineering Company	2		
Manitowoc Shipbuilding Company	9	22,831	14,750
Mathis Shipbuilding Company	3	600	2,400
Merchant Shipbuilding Corporation			
Chester Yard	11	65,780	27,500
Hartiman Yard	16	92,160	40,000
Merrill-Stevens Shipbuilding Corporation	3	18,000	6,000
Moore Shipbuilding Company	10	68,300	29,600
Nashville Bridge Company*	5	2,500	
Newburgh Shipyards, Inc.	5	27,000	14,670

TABLE I.—MERGHANT VESSELS BUILT IN THE UNITED STATES IN 1920—Continued.

SHIPYARD	NUMBER OF SHIPS	TOTAL GROSS TONNAGE	TOTAL HORSEPOWER
New York Harbor Dry Dock Corporation.....	6	11,560	7,200
New York Shipbuilding Corporation*.....	13	148,800	113,450
Newport Shipbuilding Company.....	9	5,400	5,400
Newport News Shipbuilding & Dry Dock Company.....	5	47,284	23,400
Norfolk Shipbuilding & Dry Dock Corporation.....	1		
Pacific Coast Shipbuilding Company.....	4	37,600	12,000
Pacific Marine & Construction Company.....	2	12,972	5,600
Pensacola Shipbuilding Company.....	10	54,000	33,000
Percy & Small, Inc.....	1	1,103	
Pusey & Jones Company.....	12	56,840	26,450
James Rees & Sons Company.....	2	310	324
G. D. Ryan & Son.....	1	370	
Saginaw Shipbuilding Company.....	6	25,500	9,000
Schaw-Batcher Shipbuilding Company.....	6	52,800	16,800
South Western Shipbuilding Company.....	8	46,054	20,600
Standard Shipbuilding Corporation.....	5	18,874	10,500
St. Helens' Shipbuilding Company.....	1	2,500	1,400
St. Helena Shipbuilding Company.....	1	2,500	1,400
G. M. Standifer Construction Corporation.....	6	487,000	153,000
Staten Island Shipbuilding Company*.....	9	4,227	1,000
Stockton Yards, Inc.....	2	2,600	
A. D. Storey Shipyard.....	4	900	
Submarine Boat Corporation.....	42	148,890	90,000
Sun Shipbuilding Company.....	14	92,800	42,000
Tank Ship Building Corporation*.....	8	5,600	
Tebo Yacht Basin Company.....	3	6,950	3,650
Texas Steamship Company.....	5	30,315	13,000
Todd Dry Dock & Construction Corporation*.....	8	38,400	20,000
Toledo Shipbuilding Company.....	7	17,913	10,500
E. James Tull.....	2	600	
Union Construction Company.....	6	32,825	15,300
Union Shipbuilding Company.....	5	32,200	10,600
Virginia Shipbuilding Corporation.....	5	30,300	14,000
Chas Ward Engineering Works.....	1	757	1,800
Western Pipe & Steel Company.....	8	70,400	22,400

*Yards also engaged on Naval Construction (Table III).

TABLE II.—MERCHANT VESSELS NOW UNDER CONSTRUCTION IN THE UNITED STATES

SHIPYARD	NUMBER OF SHIPS	TOTAL GROSS TONNAGE	TOTAL HORSEPOWER
American Bridge Company.....	62	26,300	
American International Shipbuilding Corporation.....	7	56,000	17,500
Anchor Shipbuilding Company.....	1		300
Baltimore Dry Docks & Shipbuilding Company.....	6	42,002	13,250
Bath Iron Works, Inc.....	1	6,250	2,400
Bethlehem Shipbuilding Corporation.....			
Fore River Plant.....	7	99,060	24,800
Harlan Plant.....	3	24,400	7,800
Moore Plant.....	2	1,500	1,400
Sparrows Point.....	13	170,020	91,500
Union Plant (Potrero).....	1	10,100	2,800
Union Plant (Alameda).....	10	118,000	28,890
Cambridge Manufacturing Company.....	4	800	
Chickasaw Shipbuilding & Car Company.....	8	45,488	24,800
Francis Cobb Shipbuilding Company.....	1	2,500	
Consolidated Shipbuilding Corporation.....	3	2,575	1,800
William Cramp & Sons Ship & Engine Building Company.....	1	3,350	3,600
Oscar Daniels Company.....	4	43,000	11,200
M. M. Davis & Son, Inc.....	2	1,700	
Doullut & Williams Shipbuilding Company.....	2	13,202	5,600
Downey Shipbuilding Corporation.....	2	4,719	3,000
Dravo Contracting Company (Engineering Works Department).....	24	3,270	500
Dubuque Boat & Boiler Works.....	2	2,500	250
Federal Shipbuilding Company.....	16	74,750	25,800
Frye-Flynn Company.....	1	1,100	
Great Lakes Engineering Works.....	1	1,400	3,000
Groton Iron Works.....	1	900	700
Job Shipyard Corporation.....	1	315	
Johnson Iron Works, Dry Dock and Shipbuilding Company, Inc.....	9	2,977	102
Johnson Shipyards Corporation.....	4	4,352	980
Kelley-Spear Company.....	2	3,250	
Kyle Purdy, Inc.....	4	2,800	1,800
Lanteri's Shipyard.....	2		
Leatham & Smith Towing & Wrecking Company.....	1	85	400
Le Parmentier Shipbuilding Corporation.....	2	8,000	2,800
Long Beach Shipbuilding Company.....	1	8,800	2,800
Los Angeles Shipbuilding & Dry Dock Company.....	5	37,300	19,000
S. C. McLouth Shipbuilding Company.....	1	200	350
Merchant Shipbuilding Corporation (Chester Yard).....	8	41,500	
Moore Shipbuilding Company.....	9	67,300	33,400
Nashville Bridge Company.....	7	3,000	300
Newburgh Shipyards, Inc.....	4	11,500	12,000
New Jersey Dry Dock & Shipbuilding Company.....	4	3,600	2,200
New York Harbor Dry Dock Corporation.....	1	3,285	1,600
New York Shipbuilding Corporation*.....	13	121,318	86,900
Newport News Shipbuilding & Dry Dock Company*.....	5	62,100	26,600
Newport Shipbuilding Company.....	10	14,875	7,800
Northwest Bridge & Iron Works.....	7	56,000	22,400
Pacific Coast Shipbuilding Company.....	4	29,400	9,500
James Rees & Sons Company.....	2	1,192	1,600
G. D. Ryan & Son.....	3	990	100
Southwestern Shipbuilding Company.....	6	38,797	17,200
Standard Shipbuilding Corporation.....	2	11,228	5,700
Standifer, G. M., Construction Corporation.....	4	48,000	12,000
Staten Island Shipbuilding Company.....	10	13,356	4,600
Stockton Yard, Inc.....	1	1,300	
A. D. Story Shipyard.....	3	700	
Submarine Boat Corporation.....	5	17,725	7,500
Tank Shipbuilding Corporation.....	2	850	900
Tebo Yacht Basin Company.....	1	1,450	
Texas Steamship Company.....	8	19,304	6,000
Todd Dry Dock & Construction Corporation*.....	1	4,000	2,400
Union Construction Company.....	5	29,319	13,400
Union Shipbuilding Company.....	4	26,800	15,000
Virginia Shipbuilding Corporation.....	1	6,060	2,800
Chas. Ward Engineering Works.....	3		

*Yard also engaged on Naval Construction (Table IV)

TABLE III.—NAVAL VESSELS BUILT IN AMERICAN PRIVATE SHIPYARDS IN 1920

SHIPYARD	NUMBER OF SHIPS	TOTAL TONS DISPLACEMENT	TOTAL HORSEPOWER
Bath Iron Works, Inc.	3	3,630	82,500
Bethlehem Shipbuilding Corporation			
Fore River Plant	8	9,191	144,200
Union Plant (Potrero)	12	13,878	272,400
Union Plant (Risdon)	12	12,700	324,000
William Cramp & Sons Ship & Engine Building Company	15	18,450	420,000
Dubuque Boat & Boiler Works	5		
Lake Torpedo Boat Company	2	1,675	2,800
George Lawley & Sons Corporation	1	850	
Nashville Bridge Company	31	6,000	
New York Shipbuilding Corporation	10	13,500	270,000
Newport News Shipbuilding & Dry Dock Company	5		
Staten Island Shipbuilding Company	6	6,000	12,000
Tank Ship Building Corporation	5	4,250	1,000
Todd Dry Dock & Construction Corporation	1	1,125	2,100

TABLE IV.—NAVAL VESSELS NOW UNDER CONSTRUCTION IN AMERICAN PRIVATE SHIPYARDS

SHIPYARD	NUMBER OF SHIPS	TOTAL TONS DISPLACEMENT	TOTAL HORSEPOWER
Bethlehem Shipbuilding Corporation			
Fore River Plant	23	108,784	445,600
Union Plant (Potrero)	22	23,240	336,000
Union Plant (Risdon)	7	8,575	189,000
Wm. Cramp & Sons Ship & Engine Building Company	7	37,960	506,000
Gulfport Shipbuilding Company	6		
Lake Torpedo Boat Company	6	6,625	10,200
New York Shipbuilding Corporation	6	112,750	315,600
Newport News Shipbuilding & Dry Dock Company	4		
Todd Dry Dock & Construction Corporation	3	21,000	270,000
Union Construction Company	5	7,364	11,400

TABLE V.—STEEL VESSELS UNDER CONSTRUCTION IN AMERICAN SHIPYARDS, DECEMBER 1, 1920

BUILDERS	OWNERS	TYPE	GROSS TONNAGE	No.	TOTAL TONNAGE
American Bridge Company	Portland Cement Company	Barge	300	3	900
American Bridge Company	Bell Iron Works	Barge	600	32	19,200
American Bridge Company	Standard Oil Company	Barge	500	4	2,000
American Bridge Company	U. S. Railroad Administration	Barge	900	25	22,500
American Bridge Company	U. S. War Department	Barge	350	6	2,100
American Bridge Company	Carnegie Steel Company	Barge	575	25	14,375
American Car & Foundry Company	Philadelphia & Reading Railroad	Barge	500	1	500
American Car & Foundry Company	Atlantic Refining Company	Oil Barge	350	1	350
Baltimore Dry Docks and Shipbuilding Company		Tanker	6,000	1	6,000
Baltimore Dry Docks and Shipbuilding Company		Freighter	4,000	2	8,000
Baltimore Dry Docks and Shipbuilding Company	Builders	Tanker	6,000	2	12,000
Baltimore Dry Docks and Shipbuilding Company	Builders	Freighter	4,311	2	8,622
Bath Iron Works	Crowell & Thurlow	Freighter	6,250	1	6,250
Bath Iron Works	Crowell & Thurlow	Freighter	6,253	1	6,253
Bethlehem Shipbuilding Company					
Fore River	Atlantic Gulf & West Indies Company	Tanker	7,800	1	7,800
Fore River	Sinclair Navigation Company	Tanker	6,600	2	13,200
Fore River	Standard Transportation Company	Tanker	7,800	1	7,800
Fore River	Standard Transportation Company	Tanker	7,794	2	15,588
Harlan Plant	Sinclair Navigation Company	Tanker	7,077	2	14,154
Harlan Plant	Sinclair Navigation Company	Tanker	4,500	2	9,000
Moore Plant	Standard Transportation Company	Tanker	1,200	1	1,200
Moore Plant	Western Maryland Railroad	Car Floats	1,200	2	2,400
Sparrows Point	Ore Steamship Company	Tanker	13,500	1	13,500
Sparrows Point	Lux Navigation Company	Tanker	5,845	2	11,690
Sparrows Point	International Petroleum Company	Tanker	13,500	1	13,500
Sparrows Point	Atlantic Gulf & West Indies Company	Tanker	7,800	2	15,600
Sparrows Point	Standard Transportation Company	Tanker	6,900	1	6,900
Sparrows Point	Standard Transportation Company	Tanker	7,500	1	7,500
San Francisco	General Petroleum Corporation	Tanker	7,060	1	7,060
San Francisco	Pan American Petroleum & Transportation Company	Tanker	7,060	1	7,060
San Francisco	Standard Oil Company of California	Tanker	7,060	1	7,060
San Francisco	Standard Oil Company of California	Tanker	8,650	1	8,650
San Francisco	Standard Transportation Company	Tanker	7,060	1	7,060
San Francisco	Associated Oil Company	Tanker	7,100	1	7,100
San Francisco	Standard Oil Company of California	Tanker	10,000	3	30,000
Brunswick Marine Corporation	R. L. Smith	Freighter	960	1	960
Wm. Cramp & Sons Ship and Engine Building Company	Florida East Coast Railway	Freighter	2,406	1	2,406
Wm. Cramp & Sons Ship and Engine Building Company	Peninsula & Ocean Steamship Company	Pass. & Cgo.	2,000	1	2,000
Oscar Daniels Company	Standard Oil Company of New Jersey	Tanker	7,800	1	7,800
Oscar Daniels Company	Builders	Tug	350	1	350
Downey Shipbuilding Company	Southern Pacific Company	Freighter	3,850	3	11,550
Downey Shipbuilding Company	Mexican Petroleum Company	Oil Carrier	550	1	550
Dravo Contracting and Construction Company	United States Railroad Administration	Barge	273	4	1,092
Dravo Contracting and Construction Company	United States Railroad Administration	Barge	1,500	2	3,000
Dravo Contracting and Construction Company	Keystone Sand & Supply Co.	Barge	200	4	800
John Eichleay Company	United States Engineers	Towboat	200	1	200
John Eichleay Company	Western Kentucky Coal Company	Towboat	200	1	200
Federal Shipbuilding Company	War Department	Barge	350	1	350
Kearny, N. J.	Standard Oil Company	Tanker	10,000	5	50,000
Kearny, N. J.	Mexican Petroleum Company	Barge	450	4	1,800
Kearny, N. J.	United States Steel Products	Freighter	6,000	3	18,000
Chickasaw, Ala.	Builders	Freighter	6,869	1	6,869
Chickasaw, Ala.	United States Steel Products	Freighter	6,000	9	54,000
Geo. A. Fuller Company	Builders	Freighter	6,121	4	24,484
Globe Shipbuilding Company	Builders	Freighter	5,700	2	11,400
Great Lakes Engineering Works	Horace E. Dodge	St. Yacht	600	1	600
Johnson Iron Works	Builders	Barge	200	3	600
Kyle & Purdy	International Petroleum Company	Tug	100	1	100
Kyle & Purdy	Atlantic Gulf Oil	Tug	100	1	100
Kyle & Purdy	East Coast Fisheries	Trawler	670	2	1,340
Kyle & Purdy	Max Fleischman	Yacht	250	1	250
Lawley & Son, Geo.	Edgar Farnum	Aux. Yacht	350	1	350

(See American Bridge Co.)

TABLE V.—VESSELS UNDER CONSTRUCTION IN AMERICAN SHIPYARDS, DECEMBER 1, 1920. (CONTINUED).

BUILDERS	OWNERS	TYPE	GROSS TONNAGE	No.	TOTAL TONNAGE
Manitowoc Shipbuilding Company	Atlantic Fruit Company	Fruit Str.	1,600	1	1,600
Manitowoc Shipbuilding Company	Builders	Freighter	2,712	3	8,136
McDougall-Duluth Company	Julius Barnes	Freighter	1,580	1	1,580
Merchant Shipbuilding Corporation	Union Oil Company (Del.)	Tanker	6,250	2	12,500
Merchant Shipbuilding Corporation	American Hawaiian Steamship Company	Freighter	7,800	2	15,600
Merchant Shipbuilding Corporation	Shawmut Steamship Company	Freighter	7,300	2	14,600
Merchant Shipbuilding Corporation	Cochran Harper Company	Tanker	6,250	2	12,500
Merrill-Stevens	Arellano-y-Mendoza		300	1	300
Moore Shipbuilding Company	Matson Navigation Company	Freighter	9,500	2	19,000
Moore Shipbuilding Company	Standard Oil Company of California	Tanker	3,250	1	3,250
Moore Shipbuilding Company	Standard Oil Company of California	Tanker	7,000	3	21,000
Moore Shipbuilding Company	Vacuum Oil Company	Tanker	7,000	1	7,000
Moore Shipbuilding Company	Southern Pacific Company	Tanker	9,600	1	9,600
Moore Shipbuilding Company	Vacuum Oil Company	Tanker	7,039	1	7,039
Newburgh Shipyards, Inc.	Cuyamel Fruit Company	Freighter	3,000	2	6,000
Newburgh Shipyards, Inc.	Union Sulphur Company	Freighter	4,700	1	4,700
New Jersey Dry Dock Company	East Coast Fisheries	Trawler	355	2	710
Newport News Shipbuilding & Dry Dock Company	Atlantic, Gulf & West Indies Company	Tanker	10,600	2	21,200
Newport News Shipbuilding & Dry Dock Company	Standard Oil Company of New Jersey	Tanker	13,500	2	27,000
New York Harbor Dry Dock Corporation			3,285	2	6,570
New York Shipbuilding Corporation	Pacific Mail Steamship Company	Tanker	6,800	1	6,800
New York Shipbuilding Corporation	United Fruit Company	Tanker	6,800	1	6,800
New York Shipbuilding Corporation	Standard Transportation Company	Tanker	7,794	4	31,176
New York Shipbuilding Corporation	Munson Steamship Company	Freighter	6,000	1	6,000
New York Shipbuilding Corporation	Builders	Tanker	6,800	2	13,600
Northwest Bridge & Iron Company	Swiftsure Oil Transportation Company	Tanker	9,000	7	63,000
Pacific Coast Shipbuilding Company	Associated Oil Company	Motor Tk.	188	1	188
Pacific Coast Shipbuilding Company	Associated Oil Company	Tanker	1,000	1	1,000
Pensacola Shipbuilding Company	Morris Adler	Tug	300	1	300
Pusey & Jones Company	Philadelphia & Reading R. R.	Pass. Ferry	773	2	1,546
Rice Bros.	Atlantic Coast Fisheries	Trawler	400	4	1,600
Southwest Shipbuilding Company	Luckenbach Steamship Lines	Freighter	6,100	1	6,100
Southwest Shipbuilding Company	Union Oil Company of California	Tanker	8,650	2	17,300
Southwest Shipbuilding Company	Anglo Saxon Petroleum Company	Tanker	5,600	3	16,800
Southwest Shipbuilding Company	Union Oil Company of California	Tanker	4,788	1	4,788
Spedden Shipbuilding Company	Standard Oil Company of N. J.	Barge	995	1	995
Spedden Shipbuilding Company	Builders	Tug	325	1	325
Standard Shipbuilding Corporation	Cuyamel F-uit Company	Fruit Str.	900	2	1,800
Standard Shipbuilding Corporation	Eagle Oil Transportation Company	Tanker	5,600	4	22,400
G. M. Standifer Construction Company	Standard Oil Company of New Jersey	Tanker	8,250	3	24,750
G. M. Standifer Construction Company	Imperial Oil, Ltd.	Tanker	8,250	2	16,500
Staten Island Shipbuilding Company	Galena Signal Oil Company	Tanker	2,500	1	2,500
Staten Island Shipbuilding Company	American Sugar Refining Company	Tanker	4,200	1	4,200
Staten Island Shipbuilding Company	Standard Oil Company of New York	Motor Barge	450	1	450
Staten Island Shipbuilding Company	Standard Oil Company of New York	Barge	1,200	3	3,600
Staten Island Shipbuilding Company	Standard Oil Company of New York	Barge	420	5	2,100
Submarine Boat Corporation	Builders	Freighter	3,545	7	24,815
Sun Shipbuilding Company	Sun Oil Company	Tanker	8,533	3	25,599
Sun Shipbuilding Company	Atlantic Gulf & West Indies Company	Tanker	6,800	1	6,800
Sun Shipbuilding Company	Atlantic Gulf & West Indies Company	Tanker	9,000	4	36,000
Sun Shipbuilding Company	Atlantic, Gulf & West Indies Company	Tanker	6,700	1	6,700
Sun Shipbuilding Company	Pan American Petroleum & Transportation Company	Tanker	6,700	2	13,400
Sun Shipbuilding Company	Sinclair Navigation Company	Tanker	6,700	2	13,400
Sun Shipbuilding Company	Standard Oil Company of New Jersey	Tanker	6,800	2	13,600
Sun Shipbuilding Company	Union Oil Company	Tanker	9,000	2	18,000
Sun Shipbuilding Company	Societe Anonyme d'Orient d'Industrie	Tanker	6,800	1	6,800
Sun Shipbuilding Company	Tidewater Oil Company	Tanker	6,800	1	6,800
Sun Shipbuilding Company	Norwegian American Line	Tanker	6,800	1	6,800
Tank Shipbuilding Corporation	Panuco Exploration Company		750	1	750
Tank Shipbuilding Corporation	Beacon Oil Company		500	1	500
Tank Shipbuilding Corporation	Sunset Fuel Oil Company	Oil Barge	1,250	1	1,250
Terry Shipbuilding Corporation	United States Mexican Oil Transportation Company	Tanker	5,193	1	5,190
Texas Company	Builders	Tanker	6,700	4	26,800
Texas Company	Builders	Mot. Tk.	3,500	1	3,500
Texas Company	Builders	Barge	750	3	2,250
Todd Dry Dock & Construction Company	Alaska Steamship Company	Freighter	3,900	1	3,900
Union Shipbuilding Company	Builders	Freighter	7,150	4	28,600
Union Shipbuilding Company	Gulf Refining Company	Tanker	6,700	2	13,400
Union Construction Company	General Petroleum Company	Tanker	7,000	1	7,000
Union Construction Company	Standard Oil Company of California	Tanker	7,000	1	7,000
Union Construction Company	Standard Oil Company of California	Motor Tk.	1,650	1	1,650
Union Construction Company	Shell Oil Company	Tanker	7,000	1	7,000
Union Construction Company	Anglo Saxon Petroleum Company	Tanker	5,600	3	16,800
Virginia Shipbuilding Corporation	United States Steamship Company	Freighter	6,060	3	18,180

341 1,300,710

TABLE VI.—STEEL VESSELS UNDER CONSTRUCTION FOR THE UNITED STATES SHIPPING BOARD DECEMBER 20, 1920.

BUILDERS	TYPE	D. W. TONNAGE	No.	TOTAL D. W. TONNAGE
American International Shipbuilding Corporation	Transport	8,000	5	40,000
Baltimore Dry Docks & Shipbuilding Company	Tanker	10,300	1	10,300
Baltimore Dry Docks & Shipbuilding Company	Tanker	6,000	1	6,000
Baltimore Dry Docks & Shipbuilding Company	Tanker	10,200	4	40,800
Bethlehem Shipbuilding Company:				
Harlan Plant	Cargo	7,400	1	7,400
Sparrows Point Plant	Cargo & Pas.	13,000	5	65,000
San Francisco Plant	Tanker	10,100	3	30,300
San Francisco Plant	Cargo	11,800	1	11,800
Wm. Cramp & Sons Ship & Engine Building Company	Cargo	9,400	1	9,400
Oscar Daniels Company	Cargo	9,500	3	28,500
Doullut & Williams Shipbuilding Company	Cargo	9,600	7	67,200
Groton Iron Works	Cargo	9,400	1	9,400
Hanlon Dry Dock & Shipbuilding Company	Cargo	5,300	1	5,300
Long Beach Shipbuilding Company	Cargo	8,800	1	8,800
Los Angeles Shipbuilding & Dry Dock Company	Cargo	8,800	3	26,400
Los Angeles Shipbuilding & Dry Dock Company	Cargo	11,000	5	55,000
Merchant Shipbuilding Corporation:				
Harriman Plant	Cargo	9,000	5	45,000
Moore Shipbuilding Company	Cargo	9,400	1	9,400
Moore Shipbuilding Company	Tanker	10,000	3	30,000
Newburgh Shipyards, Inc.	Cargo	9,000	1	9,000
Newport News Shipbuilding & Dry Dock Company	Cargo	13,000	2	26,000
New York Shipbuilding Corporation	Pas. & Cargo	13,000	13	169,000
Pacific Coast Shipbuilding Company	Cargo	9,400	3	28,200
Pusey & Jones Company (Gloucester yard)	Diesel Cargo.	12,500	1	12,500
Saginaw Shipbuilding Company	Cargo	4,050	1	4,050
Virginia Shipbuilding Company	Cargo	9,400	1	9,400
Kiangnan Dock & Engineering Works (Shanghai, China)	Cargo	10,000	4	40,000

78 814,150

Brace Up, America! Don't Give Up the Ships!!

We Have the Ships, the Men, the Money, the Banking and Insurance Facilities: Why Not Make Shipping Pay?

BY C. A. MC ALLISTER

THESE be "parlous" days we are passing through in merchant marine matters. What with head lines in the daily papers featuring up all kinds of graft and irregularities in connection with our shipping efforts; with freight rates gone to smash; with few contracts being made for new ships, and a general air of depression engulfing us wherever we turn, times, indeed, seem bad and the future dark and dreary.

As a youth the writer was taught that under similar circumstances, which must come to all at one time or another, it is very consoling to consider two things, the first of which is how much worse it could be, and the next, how does it affect the other fellow? Therefore the object of this brief article will be to show that somewhere the sun is shining and that things maritime are not so bad as they seem.

WRONG IMPRESSIONS FROM SHIPPING BOARD INVESTIGATION

Let us first look into this investigation which has so shocked the public. Admittedly it came at a very inopportune time, as the daily press just finished up with the details of a presidential election and just prior to the many news features incident to the opening of Congress, was in a peculiarly receptive condition to magnify most trivial and ordinary details of the investigation, which at any other time might have drawn a small paragraph instead of flaming headlines. Mr. Average Citizen, as we all know, only reads headlines concerning everything except the small portion of a daily devoted to some particular subject in which he may be specially interested. Hence, at this writing, in the public eye for a fleeting moment or so, everyone connected with shipbuilding, ship operating, etc., must be a low-down grafter. How unfortunate this impression is, and also how untrue! While the writer would be the last one to condone anything crooked in the expenditure of public money and hopes fervently that everyone who has maliciously misappropriated any Shipping Board money may promptly be jailed, there are certain extenuating circumstances which must be taken into consideration in a just analysis of the Board's activities since its formation.

The first of these may be expressed by the simile of the man who neglected during a long period of fine weather to put a new roof on his barn, and then when the storm broke rushed wildly to make good his neglect by putting on the roof during the worst part of the storm in order to protect the goods he had stored therein. Naturally the new roof cost a vast sum of money and many of the contents of the barn were spoiled or wasted in the process. Almost exactly a similar condition existed with our merchant marine; we had neglected all warnings and advice for a fine weather period of over half a century, and then tried to make good that long period of neglect by constructing hundreds of the essential ships during two or three years of the greatest storm that ever struck this mundane sphere. The result has been waste and profligacy, as must inevitably have occurred. So let us be frank with ourselves and liken the early efforts of the Shipping Board to that far-famed orchestra in a mining town theater which gave rise to the story of how their lives were saved from the frenzy of the red-shirted miners by the imprecations "Don't shoot the musicians, boys, they are doing the best they can." In other words, again to resort to musical terms, the American people have had to pay the fiddler for

their own neglect in the past. And it was not alone in the Shipping Board's activities that we have had to pay the fiddler—just look at the billions we sank in aeroplanes, heavy guns, improvised submarine patrol boats, etc., as the result of our national lack of policy and putting on the roof after the storm breaks. Let us hope that after all these investigations have ceased the thinking public will, in retrospect, put the blame for the greater part of all these shortcomings where it rightfully belongs—on ourselves.

PETTY GRAFT

Great agonizing has been indulged in because, forsooth, some stewards, chief engineers and captains have secured certain commissions or rake-offs on goods which they have purchased to operate Shipping Board vessels. While such methods are nothing less than vicious, they are but akin to tipping hotel waiters, hat holders, Pullman porters and the whole gamut of the gentry who hold out their hands for something to which they are not entitled. While it is probable that no similar grafting was indulged in when Noah's Ark was outfitted for her forty-day voyage, simply because of the fact that all the inhabitants of the earth were on board, it is doubtful if any other maritime expedition or voyage since that time has entirely escaped from some form or another of this pernicious practice. Human nature is the same yesterday, today and tomorrow, and the only essential differences between our boasted civilization of today and the dark ages are that the engineer has made living more comfortable and Christianity has taught us to curb natural inclinations. The best that man can do to reform his fellowman is to keep a strict watch on the suspected ones; petty graft in outfitting ships can thus be kept in check by improvements in purchasing systems and strict inspections.

This is now being done to the best of the ability of those at present in charge of all Shipping Board activities, and the regrettable thing about this whole investigation is that it brings out at this time certain shortcomings which occurred in the early days when the storm raged the fiercest. After all it is probable that these exposures will act like a thunder shower in clearing up a murky atmosphere. Let all malicious offenders be punished as is their just due, but let us after it is all cleared up look to the future, as that is what we are all most deeply interested in at this time.

SHIPPING SHOWS HIGHEST SALVAGE PERCENTAGE OF ANY WAR INVESTMENT

Looking forward, then, we have one great consolation to be thankful for, and that is, despite the wastage incident to the war there is no activity in which the Government engaged which can show so high a percentage in salvage value as our investment in ships. What we now have on hand cost probably twice as much as their market value today. What other war expenditure can show a present value of anywhere near 50 percent. Some of the ships, due to hasty war construction, are not up to the standard output of normal times, and we had no right to expect that they would be. When riveters had to be made out of bartenders, barbers and baseball players with only two or three months' training we have no right to criticize the work they did. Fortunately the bulk of the fleet, although contracted for and commenced during the period before the armistice, was largely constructed within the

past two years, when hasty construction was not an object and where the efficiency of the new men drawn into the yards has constantly increased. After the undesirable wooden ships and the small steel ships are disposed of in the best manner possible under the circumstances we will have remaining a fleet of American ships that will compare favorably with the ships of our competitors, and, in fact, as we had a relatively small number of older ships to bring down the average efficiency it is probable that our entire fleet will be superior to any other in the world, as other nations will still have a large percentage of the older ships to lower their average efficiencies.

It cannot be denied that freight rates at this time are all shot to pieces. They have tumbled over 50 percent in six months' time, largely due to the inexorable law of supply and demand. Our principal customers in international trade are not yet on their feet in a productive way, consequently they have but few manufactured goods to sell us. For the past three years our ocean commerce has been largely a one-way transaction, as attested by the large number of American ships which return to our ports in ballast. Statistics show, however, that normal conditions of trade are rapidly approaching. Our exports for this year will exceed our exports for the preceding year, yet this gain is but small in comparison with our rapidly increasing imports as European countries are resuming output. Based on the ocean trade of today, if the United States does 60 percent of its own sea carrying, and even with the current freight rates the estimated revenues from that source will be over \$600,000,000 per annum. This will represent a gain in pre-war conditions of possibly a half billion dollars in our national revenues.

NATIONAL REVENUES INCREASED BY SHIPPING

It has been estimated that Great Britain, the greatest of all sea carriers, received as revenues from her shipping in the last calendar year approximately \$2,300,000,000. It is this indirect income which enables that empire to offset what would otherwise be a hopeless balance of trade against her. Heretofore it has been a great problem for America to maintain her balance of trade with the incessant drain on our resources to pay interest on American securities held abroad, augmented by the millions of dollars spent annually by American tourists abroad. Added to those was the incessant drain on our resources in payments made to foreign shipowners and marine insurance underwriters in maintaining our sea commerce. It has been claimed that it took the entire revenue from our cotton exports, of which we have had practically a monopoly, to offset these very serious inroads on our debit side of the ledger in international trade.

We therefore approach the new order of world conditions with the United States occupying the premier position in the world's financial standing. We have stopped the drain on our financial resources because of excessive interest payments by purchasing the greater part of our securities formerly held abroad and we may reasonably expect the principal nations of Europe at no distant date to be paying interest to us on the enormous loans made to them in the time of their national needs. We have our own ships and may reasonably expect to keep the bulk of our expenditures for ocean carrying and marine insurance within our own borders. To accomplish this latter we must, however, exercise reasonable business acumen, which we are well capable of doing, and reform our ways from the reckless methods which we have already fallen into in dealing with our shipping. It is to this latter problem which we must apply our best efforts.

AN "ADJUSTMENT" WITH AMERICAN SHIPOWNERS NECESSARY

It will be sinful for us supinely to lie down at this juncture and say that the problem is hopeless. While we must admit at the outset that the expense of operating our ships will be

greater than that of our competitors from the simple fact that American standards of wages and living are now and probably always will be higher than those of any other nation. This must be recognized and means provided for offsetting it. As President-elect Harding has so ably expressed it, there must be an "adjustment" with American shipowners to offset the additional expenses placed on our shipping by the requirements of the Seaman's Act.

What form this "adjustment" will take remains to be developed. If it must be a direct subsidy, I am firmly of the opinion that the American people have become educated up to the point where to insure the permanency of our immense national investment in ships, and to capture the prize of retaining within our own borders the immense sums to be derived from carrying the bulk of our ocean-borne commerce with its concomitant insurance, even that method will be forthcoming from our law makers. Yet it is hoped that with the laws already on our statute books in the shape of the much discussed Jones bill, this direct subvention will not become necessary.

PREFERENTIAL DUTIES CLAUSE OF THE JONES BILL

The preferential duties clause of this act is possibly the way out, and it remains to be seen if the new administration will not be able to repeal the treaties, so vitally necessary for the proper enforcement of this legislation, without seriously jarring amicable relations with the nations involved. Potentially this method of preference to our own ships is very promising. It is by no means a new procedure, as history records that one of the first acts of the continental Congress was the passage of a measure giving goods imported in American bottoms a 10 percent preference in tariff rates. It is also a matter of history that as a direct result of this preference, American shipping increased over 400 percent in the short space of five years. If the present authority for a 5 percent preference in tariff rates does only half as well, there need be no anxiety as to the future of our merchant marine efforts.

PREFERENTIAL RAILROAD RATES

The preferential railroad rates to be granted for goods exported in American bottoms is another very promising method of applying this "adjustment" to American ships. It will take time to develop just how beneficial these laws will be. In the meantime an era of rigid economies must be commenced by our ship operators.

HOW OPERATING EXPENSES CAN BE REDUCED

The officers and men who man our merchant ships must recognize that they must do well their parts to make our merchant marine a success. Their very livelihood depends upon it. While receiving the better pay and better board they must recognize that it is incumbent upon them to cut out everything resembling graft; they must improve their efficiency and greatly reduce the onerous repair bills with which American ships have been inflicted on account of inefficiency and laziness on the part of many of them in responsible positions. They must at once recognize the fact that American ships cannot compete with foreigners, if, in addition to the higher rates of pay they receive, they make insistent demands on owners for "overtime" in doing work which they ought to do during their regular eight-hour shifts. These demands are akin to the largess paid to old-time pirates; all patriotic American merchantmen should unite in cutting out this expense at once. It may have gone all right when freight rates were profligate, but in these days and the days to come it will no longer go. Let that be the first contribution to the good of the cause, on the part of the officers and men operating our ships.

While the greater proportion of our merchant shipping must be confined to the carrying of freight, it must not be

forgotten that we have made a good start and have a somewhat pretentious programme in passenger carrying on the seas. Already new lines have been started to Europe and South America and are giving evidences of success. Other lines are to be established to the Orient, and as fast as the ex-German liners are reconditioned and the twenty or more new ships, originally started as troop transports, are completed, they will be placed in commission to carry ocean travelers under our flag.

AMERICAN ENTERPRISE EVIDENT IN PASSENGER SERVICE

Although this business is somewhat new to us, there are already pleasing evidences of American enterprise and brains being exercised to make travel on our ships attractive. Fortunately for our efforts there is such a shortage in passenger carrying vessels that rates are being kept at a very high level, in many routes over twice the pre-war tariffs being received by shipowners. There are thousands of emigrants waiting in Europe to be transported to our shores. Many thousands of our own citizens who have not been able to indulge in the great American pastime of visiting foreign lands, for a period of over six years, are anxiously awaiting the time when they may pawn their Liberty bonds and visit the battlefields of Europe. Many of them will prefer the novelty of sailing under the American flag, despite the rigors of a dry passage incident to our nation-wide efforts at prohibition.

Anticipating the influx of thousands of emigrants of the Jewish faith, one American vessel is already fitted up as a Kosher ship and will undoubtedly by this means secure much of the Hebrew patronage.

A novelty, believed to be the first time ever tried on passenger vessels, is the fitting of moving picture outfits on several American ships running to South America. By this means it is hoped that the ennui of a long ocean voyage and the qualms of sea sickness may be somewhat alleviated by nightly reproductions of the latest antics of Charley Chaplin, or mayhaps the more soothing acting of Mary Fairbanks. In any event, it shows that our American ship operators are alive to the desirability of pleasing their patrons.

Another incident which shows the humane side of our new operators is the practice recently adopted by a new American passenger line of furnishing each third class passenger with a neat package containing one day's rations in the shape of sandwiches and like articles of food when they leave the vessel. This serves to protect the newly arrived until they embark on trains or obtain regular boarding places from the ravages of waterfront profiteers.

In the matter of passenger carrying, American vessels will undoubtedly benefit to a greater or less extent from certain racial or national prejudices and predilections. For example, the philanthropic attitude of the United States on all occasions of national disaster will undoubtedly attract certain nationalities to travel under the flag to which they may feel indebted for past kindnesses on our part.

OUTLOOK FOR SHIPBUILDING

The outlook for new ship construction is at the moment admittedly very dark. One prominent shipbuilder recently remarked to the writer that if any one now should even hint to him that he thought of building a new ship, he, the shipbuilder, would probably chloroform him, so that when he regained consciousness he would find in his hand a signed contract. We are not alone in this sudden cessation of building activities, as conditions are said to be even worse in the United Kingdom than they are here.

Nevertheless and notwithstanding, we undoubtedly will soon begin the construction of many new ships of special types in order properly to balance our merchant fleet. The whole thing appears to hinge at this time on the exorbitant costs of labor and materials. We cannot reasonably expect

shipowners to load themselves down with new vessels at the present high prices and have them eat themselves up with depreciation, capital and insurance charges based on such high original costs. The commodity prices are tumbling more rapidly than they ever went up in a like period. These but presage the great liquidation which is bound to occur in the labor market in the very near future. Men of vision and experience in industrial affairs predict that the month of January will witness the beginning of the very rapid recession in costs of both labor and materials.

INCENTIVES FOR BUILDING NEW SHIPS

But a few months of dwindling costs will unquestionably bring out a lot of new ship contracts. Plans are already completed for at least six large American passenger vessels, which will be given out just as soon as conditions warrant it. The tax exemption clause of the Jones bill, already taken advantage of for the construction of over 300,000 tons of new vessels, will be a strong lever in encouraging a much greater investment before the next year has passed. Then, too, there is the allurements of cheap capital offered to prospective ship owners by the authorization of \$25,000,000 of Government money annually for a period of five years, to aid in the construction of highly efficient new ships.

Altogether things are not so dismal as we might be led to think in our merchant marine matters. We have made a tremendous start and the very momentum of a three billion dollar investment in shipping is bound to crush all obstacles. We cannot turn back even if we were inclined to be weak-hearted. There is just one course to pursue, and that is straight onward. We can already point with pride to certain phases of the shipping problem which are now well advanced. Americans are going to sea in ever-increasing numbers. Industrial depression on land will cause a great impetus in the recruiting of our new ships, and it will not be long before we can pick and choose our officers and men from among genuine American citizens. We have suffered from the great influx of foreigners among our ships' officers, attracted by the higher wages we are paying, and who in the last analysis are but camouflaged citizens or Americans for revenue only.

AMERICAN VESSELS AND CARGOES TO BE INSURED AT HOME

Thanks to the acumen of certain of our legislators and marine insurance leaders we are now in a position, through the several operating syndicates of underwriters, to keep the larger part of the money paid for insuring our ships and cargoes in our own pockets instead of enriching the coffers of our very rivals in the shipping business, as has been done heretofore. This insuring by home resources is greatly aided by the possession of our own classification society, so that we are no longer dependent upon our rivals to say whether or not our ships are kept in the proper condition to warrant the assumption of insurance risks. This very humiliating position in which American shipowners were placed is now no longer necessary. Our banks have responded to the demands for foreign representation in order to carry on our business abroad in a very satisfactory manner to all concerned.

Taken altogether, our merchant marine future is still bright; what we must do is to have faith, "carry on," and economize to our utmost.

AMERICAN BUREAU OF SHIPPING BULLETIN.—The first number of the *Bulletin of the American Bureau of Shipping* will be issued in January, 1921. It is proposed for the present to make this a bi-monthly issue. The *Bulletin* will carry statistics of shipping compiled by the Bureau and will print special reports received from its surveyors at home and abroad. No charge will be made for the *Bulletin* and no advertising will be carried. The service of "A Directory of Shipping" may be added to the future issues.

The New Administration Assumes Responsibility for the American Merchant Marine

BY WALDON FAWCETT

Although the new executive administration will not assume control of the United States Government until March 4 and the new Congress will not assemble in special or "extra" session until the middle or latter part of March, it is possible thus early to appraise with accuracy the general attitude of the "new management" toward the development of the American merchant marine. Broadly speaking, this attitude may be described as unqualifiedly progressive and constructive. Analyzed from the standpoint of the shipbuilding interests, it may be said that, whereas the policy of the new government cannot, naturally, be counted upon to beget immediate reaction in the guise of contracts for new tonnage, it is impossible to doubt that the more virile Federal attitude will have precisely this result during the year 1921.

AN industry that, as in the case of American shipping and shipbuilding, waits impatiently in arrested development upon the turn of the political wheel is apt to acquire a conviction that as soon as a thing is ordered politically it is as good as done. Applying this logic to the present case there was supposition on the part of many shipping and shipbuilding interests that the national elections in November, 1920, in effect, placed the seal of popular approval upon a fully formulated working plan for the maintenance and upbuilding of the American merchant marine. The fact that the President-elect had been for years a member of the United States Senate and was supposedly familiar with all current merchant marine problems rendered it all the more plausible that the new administration should take up the reins of Federal control with a definite and detailed programme on the merchant marine, ready to hand.

NEW ADMINISTRATION MUST DETERMINE MARINE POLICY

With full knowledge that the confession may cause disappointment in some quarters, the news must be broken that the new national administration has not discounted nor pre-digested the problems of the merchant marine. The new administration is emphatically, consistently and persistently in favor of a legislative and executive programme that will attain the ideal of the fullest movement of import and export trade in American-built, American-owned and American-operated ships. This article of faith cannot be underscored too heavily. But at the same time recognition should be given to the fact that it has not and could not well have a comprehensive policy covering the details of governmental support of the merchant marine. A moment's reflection on the part of the practical captain of the industry will bring realization that there are many questions of merchant marine policy that can be intelligibly passed upon by the new President only when he has the opportunity to come into intimate contact with them at first hand. And there are other questions of future policy that must of necessity wait upon the trend of influencing legislation. Thus the general revision of the tariff, the inauguration of the "budget system" for governmental expenditures, the restriction of immigration and other projects that are in prospect will all have direct and indirect bearing upon the merchant marine issue, though precisely how remains to be ascertained.

Instead of feeling impatience that the merchant marine policy of the new administration unfolds slowly, the shipbuilding and shipping industries have reason to be profoundly grateful that the newly elected President holds unshaken to his intention, reiterated time and again during the campaign, to do everything within his power to extend and promote the best interests of the merchant marine. Cynics may have been prone to regard these assurances as the fine

promises of which a political contest is provocative. And, indeed, history records numerous instances in which presidents have departed from the ideals to which they swore fealty when in quest of votes. In the light, therefore, of the demonstrated frailties of human nature, it is reassuring to find the President-elect, at the hour of his return from a voyage to the Panama Canal, where his mind has been much given to maritime problems, pledging anew the consecration of his public service to the winning of the desired destiny for the American merchant marine.

HARDING FAVORS GOVERNMENT BACKING FOR SHIPPING

Speaking thus, at the threshold of his career as chief magistrate, Mr. Harding said: "I want to see America the greatest maritime nation on the face of the earth." Referring to the opposition to the principle of ship subsidy he characterized as "utterly blind" the men of both political parties who have been antagonistic to that prerequisite of an adequate merchant marine. Signaling his own allegiance to the ideal of governmental backing for shipping enterprises, he remarked: "If the LaFollette Seamen's Act represents the conscience of the American people, and I believe it does, then the American Government ought to step in and share the burden it imposes." Finally he declared: "What I want for America is that the ten million tons of shipping built in haste during the war shall be turned over to private management under Government encouragement."

On the authority of men close to President-elect Harding, it may be said that the prospective incumbent of the White House is the more content to rest, for the time being, on a broad, general policy of encouragement for the American merchant marine because he feels that there is now on the statute books ample law to accomplish most of the things that are needed for the upbuilding of the merchant marine. Mindful of the fact that the Republicans have been in control of Congress for the past two years, Mr. Harding is well content to take the existing laws as a foundation for the structure that he hopes to rear rather than to start anew building from the ground up. Moreover, it must be remembered that Senator Harding was a member of the upper house of Congress during the formulation and passage of the Jones Merchant Marine Act and had his part in that task. His attitude, therefore, toward the existing Merchant Marine Act is much the same as it is with respect to the recently enacted laws for the regulation of the railroads—laws, by the by, that have more application to maritime interests than some of us realize.

JONES ACT TO BE GIVEN A TRIAL

As transmitted by the counsellors who are closest to him, the conviction of the President-elect is not that the Merchant Marine Act is all sufficient and conclusive but rather that it

affords a working basis from which only minor digressions should be necessary. It may be desirable, when the law has had a thorough working test, to supplement or amend or amplify its provisions. But the incoming chief executive is understood to share the sentiment of the author of the Jones Act and many other national legislators that the merchant marine statute enacted in the spring of 1920 has had virtually no chance to function as intended. The delay in the appointment of the full membership of the Shipping Board, the refusal of President Wilson to carry out certain provisions of the law, and other untoward circumstances are regarded by sponsors of the statute as having modified if not nullified the authorization of the Jones Act. Hence the disposition on the part of the powers that be in the new administration is to have additional merchant marine legislation wait upon disclosure of a clear need for that legislation.

While there is virtual agreement on the part of the new executive administration and the leaders of the 67th Congress that what the American merchant marine requires is not additional legislation but existing laws properly applied, there is no such unity of sentiment regarding the central machinery created to carry out the will of the Government in the shipping field. The future status of the Shipping Board is fully as problematical as it has been painted in recent numbers of *MARINE ENGINEERING*. Indeed, if anything, it has become more conspicuously the butt of controversy as a result of the charges of corruption and incompetence aired sensationally this past few weeks before a special investigating committee composed of members of the House of Representatives.

Immediately following the passage of the Merchant Marine Act there was manifest on the part of the dominant party in Congress a disposition to afford the Shipping Board, as it should be forthwith constituted, every opportunity to "make good." The law makers most responsible for the Jones Act went so far as to express willingness to accept in good faith a Shipping Board dominated by men of opposite political affiliations, if the President would "make good appointments." This spirit has, it may as well be confessed, to a considerable extent, disappeared. The long delay on the part of President Wilson in naming appointees to the Board and divergence of opinion as to the qualifications of some of the men selected have operated to impair to some extent that spirit of co-operation.

FUTURE OF THE SHIPPING BOARD IN DOUBT

With the presence of new irritants, we find Congressional sentiment arrayed in three attitudes of mind, and at this stage there is ample room for conjecture as to which will ultimately prevail. First, there is the school of thought that favors acceptance of the Shipping Board as at present constituted. Second, is the sentiment that seeks retention of the form of the Shipping Board but the reorganization of its personnel as soon as the new President can make appointments. Third, is the spirit of insurgency which seeks the abolishment of the Shipping Board as an institution and its replacement by a department of the Government, under the direction of a Cabinet officer, devoted to the merchant marine and to such regularly constituted activities of the national Government as bear intimate relationship to shipping and shipbuilding interests. The strong preference of President-elect Harding for the adjustment by compromise of all controversial questions of policy renders it likely that this question of the form to be assumed by the administrative machinery of Uncle Sam's merchant marine "annex" will be disposed of in a manner designed to leave opportunity for the minimum of friction.

While the policy of the new administration toward the merchant marine has thus been assuming form, the Shipping Board, mustering for the first time its full complement of members, has grappled with a problem, consideration of which has caused to stand out in clear relief the need, in a

neglected quarter, for co-operation for the fulfillment of the dreams of an American merchant marine. The ideal that has been held up as desirable is an equitable distribution or apportionment of commerce among the several American ports and the steamer lines operating from these ports. It has focused attention as an important objective, thanks to the consideration by the Shipping Board of a plan to give effect to Section 28 of the Merchant Marine Act (known as Public Law No. 261 of the 66th Congress, Second Session). This act was approved June 5, 1920, but the operation of the section in question was suspended until January 1, 1921. The further suspension of this provision of the law, indefinitely or for a period of six months, has been the subject of earnest pleas to the Shipping Board by representatives of commercial bodies and other interests on the Pacific Coast.

ENFORCEMENT OF SECTION 28

As our readers are aware, Section 28 is the "heart" of the Merchant Marine Act in so far as it is the intent of that act to confine the American export and import movement to vessels documented under the laws of the United States. From the time the new statute was approved the Shipping Board has declared that it discerned, on the part of foreign shipping interests, and particularly those operating from the Pacific Coast, an effort to provoke opposition to this provision of the law through threat to divert foreign carriers from the American ports on the Pacific to Canadian Pacific ports or to United States ports on the Atlantic or Gulf coasts.

The debate and the alleged campaign of propaganda, pro and con, which has grown out of this situation on the Pacific Coast has made the purpose and prospective effect of Section 28 even more of a controversial issue than it would otherwise have been. The situation has been further complicated for those in authority at Washington by the fact that Pacific Coast interests have shown no spirit of unity. Interests at the north Pacific ports, that have been articulate, have vigorously opposed the enforcement of Section 28, whereas interests in Los Angeles have been equally emphatic in endorsement of the letter and spirit of the section. Ostensibly, only Pacific Coast interests are concerned, since it is only on the Pacific Coast that there are effective the differentials created by the special "export and import rates." Far-sighted students of the situation suggest, however, that shipping and shipbuilding interests on the Atlantic coast have more reason than they realize to give heed to this issue in that, should the foreign vessels in Pacific commerce be diverted to the Panama Canal and thence to Atlantic and Gulf ports, the additional tonnage would impose extra responsibilities upon port, terminal and ship repair facilities that could not fail to have effect.

In recent conferences with the spokesmen for Pacific Coast interests the Shipping Board officials have found it necessary constantly to emphasize the fact that they are permitted to exercise their discretion with respect to Section 28 only in the event that it can be demonstrated to them that there is not available in a given quarter or on given trade routes adequate tonnage to care for the traffic that exists. Congress had in view that its move in behalf of the upbuilding of an American merchant marine should not, however worthy its intent, operate to restrict commerce coming or going. Accordingly it requires the Shipping Board to certify to the Interstate Commerce Commission and the Commission to suspend the provisions of the Section where American shipping facilities are inadequate. It was in accordance with that reservation that Section 28 was held inoperative throughout the calendar year in which the new law came into existence.

To the dismay of Shipping Board officials most of the representatives of shipping and shipbuilding interests and spokesmen for commercial bodies who have, at the close of the year, appeared to press their views with respect to the permanent policy to be formulated under Section 28 have shown a disposition to discuss the question whether there is

justification for the presence in the law of that significant section. The Board has found it necessary to admonish almost every person who has sought a hearing that this is not the point at issue. Broadly speaking, the Board has no alternative but to enforce the law since it is the law. The only element of doubt arises from the question whether the time is yet ripe to apply the new exactions. And just here it may be added that the Shipping Board has never had any contemplation of a sweeping application of Section 28 to all trade routes. All that has at any time been contemplated was the inauguration of the preferential system with respect to certain ports.

IS THE SUPPLY OF AMERICAN TONNAGE ADEQUATE?

The crux of the matter then is the question whether or not the supply of tonnage of American registry is "adequate," inadequacy of tonnage being the only allowable excuse for suspension of the requirements under Section 28, and to this conundrum the Shipping Board has sought to confine the remarks of its volunteer advisors, although the concentration has not been attained without some difficulty. Meeting the limitations of the discussion, the spokesmen for commercial bodies have insisted that there is in fact a shortage of American tonnage on the Pacific Coast, at least with respect to certain classes of traffic, and that inasmuch as it cannot be definitely predicted when this shortage can be overcome the suspension of Section 28 should continue, with an understanding that at least six months' notice of enforcement would be given in order that all interests affected might have ample opportunity to adjust themselves to the contemplated conditions.

Maritime men will not miss the fact that in this debate on Section 28 it is the principle of the preferential on the export and import rate that is in reality on trial. Interest in the outcome on the part of various elements on the Pacific Coast is obvious and immediate. But in reality there is in this issue a deal of significance not only for the shipping and shipbuilding interests of the country at large but for the entire transportation industry, because weighing in the balance is the policy that apportions, allocates and distributes the available aggregate traffic among the several United States ports without too fine a regard for bare economies as represented by the length of rail hauls to the respective ports. It has already been disclosed that, if the "base ports" of New York, Philadelphia and Baltimore have only what might be termed a negative interest in this issue, the south Atlantic and Gulf ports have an interest second only to that of Pacific ports.

DISTRIBUTION OF TRAFFIC AMONG TRANSCONTINENTAL RAILROADS

The whole discussion is most opportune because there impends an effort to perfect the system of export and import rates as designed to bring about, among other things, a balance of traffic among the transcontinental railroads of the United States. It may be recalled that, during the war, the United States Railroad Administration threw overboard the system that had been worked out by the railroads to equalize traffic. The post-war revival of the old programme was interrupted by the general increase in railroad rates a few months ago. This made necessary a revision of all tariffs and this is yet far from accomplishment. However, in recent conferences at the Shipping Board—conferences in which traffic managers of the leading transcontinental railroads were participants—it was made clear that sentiment is rapidly crystalizing in favor of a system of "equalizing" rail rates as the only adequate medium for the distribution of traffic in proper proportion among all the ports of the United States that are entitled, by geographical position and port facilities, to share in her commerce.

Out of a rich experience as Director of Traffic of the United States Railroad Administration in the war period, Vice-president Chambers, of the Santa Fe system, has coun-

seled the Shipping Board that only by co-operation can this route to the development of American commerce be traveled in safety. He has urged avoidance of all embargoes and expedients to force traffic—the arbitrary policies that inevitably injure certain interests and provoke antagonism. Instead, this railroad executive, whose sentiments have been fervently echoed by others, urges that a system be worked out by all interests—carriers, shippers, shipbuilders, merchants, etc.—making common cause in a conciliatory spirit.

In the name of the San Francisco Chamber of Commerce it has been urged upon the Shipping Board that a conservative policy be at all times pursued in the enforcement of Section 28 of the Merchant Marine Act because of the difficulty of diverting a "trend of traffic," once established. It is obvious that a traffic movement, once started in a given direction, will, if other things be equal, tend to stay there. Applying this moral, the San Francisco representatives have argued that, if virtually the entire export and import movement of the United States be concentrated at a few gateways on the Atlantic coast, it will ultimately come about that American ships on the Pacific, operating from Pacific ports, will be left without cargoes. In this same connection much has been made of the contention that a certain proportion of the commerce to and from the United States will be able to defy the full force and effect of Section 28 owing to the close relations that exist in certain foreign countries between the governments, the manufacturers and exporters, the bankers and the ship-owning interests. A vice-president of the Northern Pacific Railroad has told the Shipping Board that as a result of the "community of interest" that exists in certain ship-owning countries the business that is brought under control through this team work will follow their ships wherever they may go.

MORE AMERICAN TONNAGE NEEDED ON THE PACIFIC

As for question of the adequacy of available tonnage on the Pacific, on which consideration hinges the future policy of the Shipping Board under Section 28, the best information that has come to the Board is to the effect that there is not American tonnage for all traffic. There is pretty general admission of the fact that United States tonnage may be found for all slow-moving cargo offered at this time. But for the cargo that requires speedy transit—virtually the equivalent of passenger service—the United States documented Pacific fleet is declared inadequate. As will be appreciated, moreover, this is an exceedingly important element of Pacific commerce. It involves the movement from the Orient to the Occident of tea, matting and, notably, silk—commodities of high valuation where the interest rates and insurance rates render time of passage a first consideration. The claim that silk does not at present find adequate tonnage on the north Pacific, in conjunction with the fact that on December 1 passenger accommodations were represented to be booked up to March 1, has been offered in support of the contention that there is a serious lack of a certain class of tonnage. On the other hand, dissenting opinion has suggested that silk might be handled in ships less speedy than those usually considered in connection with this traffic. The judgment of the Shipping Board with respect to its future policy has also been swayed by the fact that it has plans to place in service on the Pacific an increased complement of precisely the class of vessels that are represented as most lacking.

REMEDIES FOR CONGESTION IN PORTS

The situation that has developed on the Pacific seems bound to lead, ultimately, to the raising of the broader question of what policy will be followed, under the new administration, in enforcement of Section 8 of the Merchant Marine Act. This is the section which deals with the promotion, encouragement and development of ports and transportation facilities in connection with water commerce and which em-

powers the Shipping Board to go in quest of remedies for congestion of commerce in ports. There is one school of thought in official circles which holds that the Shipping Board may go ahead fearlessly in enforcement of Section 28, confident that any threatened diversion of traffic such as has been feared by Pacific Coast interests may be corrected under Section 8 by recommendations to the Interstate Commerce Commission with respect to the direction or compulsory diversion of traffic. A contrary opinion holds that whereas such dictation might be acceptable in an emergency, such as arose during the war, permanent "orders" in time of peace for the artificial movement of commerce would be bitterly resented and opposed. Out of the discussion that has arisen is likely to come an indication of the extent to which Section 8 of the new law may be employed to checkmate foreign shipping interests that may attempt to dodge or practice retaliation for the provisions of the Merchant Marine Act.

EFFECT OF TARIFF REVISION

Of all the policies of the new national administration it is doubtful if any be of greater consequence to shipping and shipbuilding interests than those to be expressed in a general revision of the tariff. The influence might at first glance appear to be indirect, but it is potent and far-reaching nevertheless. It goes without saying that if the vessels of the American merchant marine are to be operated at a profit they must be assured cargoes in both directions at every round trip, and upon this condition of operation the tariff policy of the nation will have important bearing. Similarly, it requires no stretch of the imagination to discern a connection between tariff policy and the preferential treatment for American vessels in the matter of Panama Canal tolls to which the new administration stands committed. Finally, it is plausible that the future tariff policy of the United States may be a factor to be reckoned with in the new status in international trade should there be carried out that provision of the Merchant Marine Act which contemplates the abrogation of commercial treaties or portions of treaties now in effect between the United States and various foreign powers.

With the thought that shipbuilders and shipowners and operators may conceive themselves to be parties at interest in a revision of the tariff, it may be remarked that it is none too

early for action if the sentiment of the maritime industries is to be made a matter of record for the benefit of the law makers who will be charged with the task of revision. While it is well understood that the actual revision waits upon the initial session of the new Congress in the spring and may not be completed ere the autumn of 1921, the preliminary hearings, wherein business sentiment is given opportunity to register its wishes, will be carried on during the first three months of the year. These hearings reveal a sharp cleavage, even within the ranks of the Republican party. On the one hand there are the "high protectionists," so called, who seek to "protect" American industry by as high a tariff wall as may be reared. The sentiment for customs duties that would be all the traffic would bear also finds sympathy with those persons who would fain raise as large a proportion as possible of public revenue by this "indirect tax." Opposed to this view, apart from the dissenting voices of free traders, is the sentiment of a considerable contingent in Congress whose members are in sympathy with the policy of "protection" but who hold that if work is to be found for American cargo ships and outlets are to be had abroad for the surplus products of American factories it will not do to crimp the purchasing power of foreign peoples by raising against them a tariff wall so insurmountable that they will have no opportunity to sell their products to the one customer that is in the best position to buy.

Awaiting the will of the new administration, but with a fate difficult of prediction, is the "free zones in ports" issue as expressed in the pending bill "to provide for the establishment, operation and maintenance of foreign trade zones in ports of entry of the United States to expedite and encourage foreign commerce." It has been assumed in some quarters that because this proposal has been endorsed by the "low tariff" advocates it should have scant chance for approval in the hands of an administration avowedly committed to protectionist policies. However, there appears to be sufficient Republican support for the free-zones-in-ports proposition to bring it out of the Commerce Committee and before the Senate, and if it should appear that the project would contribute to the upbuilding of the merchant marine, the proposition is almost certain to be heard from in one guise or another.

The American Bureau of Shipping

Our Own Classification Society Whose Interests Are Those of the American Merchant Marine

ACTING President Homer L. Ferguson, of the American Society of Naval Architects and Marine Engineers, in his address at the banquet of that society held recently, stated that one of the feats already accomplished in our nation-wide efforts at the rehabilitation of our merchant marine was the building up and establishment on a firm foundation of an American classification society, the American Bureau of Shipping.

This desideratum was early recognized as one of the principal obstacles to overcome in the renaissance of our ocean shipping. Without it we would still be dependent upon the classification facilities of our leading rivals in shipping, in order to aid in accomplishing that vital concomitant of a merchant marine, a successful marine insurance system controlled within our own borders by American companies.

A group of the leading American shipowners, marine underwriters and shipbuilders early in 1916, after debating various ways and means of accomplishing this object, de-

cided that the best method of procedure would be to revive the then somewhat somnolent American institution known as the American Bureau of Shipping. This organization, chartered by the State of New York, had then been in existence for nearly half a century, but on account of comparatively small needs incident to an inconsequential merchant marine had very limited facilities for undertaking what was then seen by these men of vision, the classification of the immense fleet necessary to put the United States on the map as a contender in the ocean carrying trade. Donations of sufficient amount were immediately forthcoming from the patriotic supporters of the necessary reorganization, and Mr. Stevenson Taylor, a man well known and respected in the shipping industry, and who possessed the necessary qualifications for this great undertaking, was unanimously agreed upon to head the organization. How well he, with the patriotic backing of many leading Americans, has succeeded in the task was well expressed by Mr. Ferguson in his speech.

Overcoming almost insurmountable obstacles the organization was built up to such a point of efficiency that the United States Government, by Act of Congress approved June 5, 1920, gave it recognition and declared it to be the official classification society for all branches of the Federal Government. It also, by the same act, placed two representatives, one from the Shipping Board and one from the Department of Commerce, on its executive committee.

As a result of all these efforts this society is today capable of furnishing recognized and reliable classification in this country for all American-owned vessels, without recourse to the classification agencies of our foreign competitors. Its surveyors may be found at all the larger American seaports and at all places where ships are built or ship material is manufactured in this country.

Now that the great rush of shipbuilding in this country has subsided and we are about to enter upon normal conditions in all branches of industry, the managers of the society are engaged in perfecting various details which a national classification society should undertake in order to make it of the greatest value in building up our merchant marine in all its branches.

EXPANSION OF THE BUREAU

As our ships emerged from the building yards and became engaged in transporting our goods to the various ports of the world, it became incumbent upon the Bureau to expand its facilities for survey work at such leading parts of the globe, where they could be of the greatest service to our shipping. Hence its board of managers appropriated a sufficient sum of money to establish exclusive agencies, after thorough investigation as to our needs, at ports most frequented by our merchantmen. Already competent surveyors, American citizens carefully selected, have been located at such ports as Shanghai, Hamburg, Antwerp, Havre, Bordeaux, Buenos Aires, Rio Janeiro, San Juan, Porto Rico, Havana, etc. Non-exclusive surveyors of the Bureau are to be found at nearly all ports where American ships may call, and as rapidly as our trade expands and the conditions warrant, exclusive surveyors will be detailed from the trained force at home to the principal ports not now so covered.

An alliance has been entered into with the British Corporation, the Registro Navale Italiano and the Imperial Maritime Corporation of Japan, whereby all classification work in this country for those societies and all American Bureau inspections in ports of those countries will be looked after by the recognized exclusive surveyors of each nation. At certain other ports throughout the world exclusive surveyors for the members of the alliance will be maintained, where otherwise the condition might warrant the employment of non-exclusive surveyors only for the individual classification societies.

RULES ON INTERNAL COMBUSTION ENGINES

Recognizing the growing importance of internal combustion engines and the inadequacy of all existing classification rules for engines of this type, the American Bureau has recently thoroughly revised its rules for this type of motive power. They are to be promulgated at the beginning of the year, and all who have seen them unite in the opinion that they are the most comprehensive rules yet prepared. In addition to the services of its own technical committee on engineering the Bureau has had the co-operation and advice of a committee of engine manufacturers representative of the industry in this country.

The Bureau's policy will be conservatively to modernize or amend its rules from time to time to keep pace with scientific advancement in the art of ship and engine building, or to recognize and give the advantages of classification to those branches of marine construction which hitherto have, in a manner, been subordinated, or ignored, by other classification societies. An important field of this kind is believed

to be the standardization of rules governing the construction and equipment of the various types of harbor and river craft, such as barges, tugboats, railroad floats, river steamboats, both passenger and freight, etc., and the Bureau will shortly undertake to prepare special rules to encourage this type of classification. Marine insurance underwriters of great experience believe that such procedure would be of benefit in eventually reducing insurance rates on this class of risks.

Easthampton Radio Station

ALIVE to the practical needs of shipping, the Cutting and Washington Radio Corporation, of New York, has just opened a new commercial radio coastal station at Easthampton, N. Y., which is located on the south shore of Long Island one hundred and three miles from New York City. This location was decided upon because it was found that with the great number of vessels coming into and leaving the harbor great difficulty was experienced in handling the radio traffic and it seemed advisable to locate a station at a point sufficiently distant from New York to avoid the interference and at the same time near enough to arrange all details of decking, transmitting of commercial messages and allowing



New Radio Station on Long Island

ample time for making up of abstracts and other details of accounting. Direct telephone and telegraph wires to New York, together with a selected corps of experienced operators, insures accurate and speedy transmission of all messages sent through this station, the call letters of which are WSA.

The radio station is situated on one of the highest knolls in the town about one mile from the shore. It occupies a plot of ground some six acres in extent. The two galvanized steel towers are 300 feet apart and are 165 feet high surmounted with wooden masts which bring the total height of the antenna to 175 feet above the heavy concrete foundations.

The latest developments in antenna and counterpoise are used, the antenna being of the cage type found so efficient on battleships during the war; the counterpoise is a series of wires radiating from one corner of the radio building and practically covering six acres.

The power supply is obtained from the local electric light company and is brought to the station in a conduit twelve hundred feet long. Twenty-two hundred volts alternating current is stepped down to 220 volts, from which a motor generator unit produces the 110 volts direct current used in the operation of the radio set. A Delco light unit, in conjunction with a storage battery, is used as an auxiliary to provide against breakdown.

Branch Banks Abroad—Their Ability to Co-operate With an American Merchant Marine

BY GEORGE E. ROBERTS*

IN foreign trade we are able to observe the great interdependence of shipping, insurance, banking and merchandising much more clearly than in domestic trade. The advantage of being able to finance, insure and ship the products of the United States that are sold in foreign markets has always been obvious in the past, when this country was greatly lacking in such facilities, and the exporters of America were constant witnesses to the splendid teamwork among the members of the British, German, French or other foreign business communities. But with the changed conditions that arose from and have followed the war, it is imperatively necessary that American products, if they are to hold their own against the competition of the world, must have the assistance of banks, insurance companies and shipping lines under their own flag.

AMERICAN BRANCH BANKS ABROAD ESSENTIAL FOR EXPORT TRADE

Banking and foreign trade are so closely allied that it is not too much to say that a large volume of export trade is practically impossible without American branch banks located abroad. Conscious of this truth, American bankers of large vision realized as far back as 1914 that if the large foreign trade suddenly thrust on the country in that year was to be made a permanent feature of American business, branch banks would have to be established in the principal countries in which American goods were sold and in which American importers purchased their raw materials. Starting with the installation of branch banks in South America and in Cuba by The National City Bank of New York, this plan to assist, protect and expedite American business all over the world has grown until, under the direct supervision of the Federal Reserve Board, approximately 125 branches of American banks are now being operated abroad.

In the case of The National City Bank, which was the pioneer in the field, the bank realized from the start that if the foreign trade built up so quickly by the United States was to endure after the restoration of peace and the re-establishment of the long-settled business relations between European manufacturers and buyers in the non-manufacturing countries American sales would require the assistance of the same relative banking facilities as those of the nations with whom they must compete. To bring this about meant a large investment without hope of immediate returns in the building up of a very expensive branch bank organization, the assembling of a personnel competent to cope with foreign business conditions and the developing on the part of foreign business communities of confidence in American banks and American banking methods.

That the bank succeeded in what it planned is evidenced by its world-wide system of branches today. Not only have export and import trade been facilitated, but a solidly established system has been evolved which will be of incalculable assistance to American commerce when it is realized that world trade is again back on the highly competitive basis that characterized it before 1914. Within a year or two every advantage won for American business in foreign countries will be needed and it will then be realized how hopeless would be the struggle to maintain a large foreign trade without the accompaniment of broad and sympathetic banking facilities. While what is said here is ascribed to the branches of The

National City Bank of New York, it applies with equal force to the other institutions which have established their branches in foreign countries.

AMERICAN SHIPPING DEPENDENT UPON BANKING AND TRADE FACILITIES

The interest of the American merchant marine in this situation is direct and clear. While it is conceivable that a considerable foreign trade might be carried on by the United States and shipped abroad under alien flags, it is inconceivable that the American merchant marine can be prosperously operated without the active and intelligent support of the foreign trade section of American business. The situation is one that cuts both ways and nothing can be clearer than the advantages to be derived from using ships flying the American flag in every possible case where the goods of the United States are to be sent abroad or where American buyers have purchased materials in foreign markets.

At the present time the business world is marking time. Events are in a state of flux from which considerable changes must soon be expected. Production is at a very low ebb all over the world, but consumption goes steadily on in spite of all efforts to reduce it to a minimum. With credit over large areas of the world's surface practically non-existent, and with the exchanges in such disorder that much of the world's normal volume of international trade is paralyzed, it is natural that the shipping industry should reflect such conditions. Great quantities of tonnage are idle, while overhead operating charges run merrily along. However, this distressing situation must eventually right itself. Shipping has ever been a first-class barometer of the state of trade, and it is perhaps fair to say that its periods of prosperity are compensating influences for times of depression like the present, as they are in agriculture, manufacturing and most other industries.

BETTER SHIPPING POLICY REQUIRED

If the foreign trade structure of the United States is to be solidly maintained and the efforts of the banks and foreign traders to keep present markets for American goods is adequately supported, a better shipping policy is required. It is folly to expect that American ships can compete with those of Great Britain, Japan or other nations if the cost of operating American ships is greatly above that of their competitors. Decades of inattention to marine affairs have put American legislation and public opinion out of touch with the world's merchant marine. There is too much reliance in this country on legislative remedies for evils which are economic in their nature and which require economically sound medicine to effect a cure. To wave the flag and talk about the American merchant marine being again a familiar sight in every port is excellent for political conventions, and it graced every one of those held this year, but the world's shipping is a scene of constant struggle and goods are going to be shipped where the rate is the cheapest. Any other course on the part of an exporter than to deliver his goods at the lowest feasible charge would be economic suicide on his individual part and through him on the nation at large.

At the present time private capital and initiative in the United States is wary of investment in ships. There is a feeling, only too well grounded, that the amount of governmental supervision at present exercised over the American merchant marine is fatal to a successful attempt to build up a

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sound and profitable merchant fleet. Other countries are removing the restrictions thought necessary as war measures and are allowing their shipowners to operate their property as free lances. No matter how rich or powerful the United States may be, its ships cannot compete on the free seas of the world if their owners are shackled and manacled in the race for business.

THE GOVERNMENT MUST QUIT SHIPPING BUSINESS

It is earnestly to be hoped that the next year will witness a general agreement on the part of all concerned to get the Government out of the shipping business. The recent investigation into the nation's war-time shipbuilding programme can have evoked little but shame from the American people and a general belief that if the American merchant marine is to be successful it will be necessary to institute radically different policies and methods from those that have so far been in vogue.

With the restoration of normal business within the next few months, business transactions will be on a quite different level from those of the past six years. Sellers' markets are not likely to be seen again for a long time. Buyers will be in the ascendant and nothing will play a more important part in the determination of prices for goods sold abroad than the question of ocean freight rates. Money will not go into marine investments unless there is a fair chance for profit and if such a condition as now exists is allowed to become chronic, the same gradual disappearance of the American

flag from the seas is inevitable, although for quite different reasons than those which caused its disappearance in the decade following the Civil War.

SHIPPING CANNOT EXIST WITHOUT PROFITS

It is unthinkable, after millions of dollars have been invested by large American banks in the establishment of branch banks abroad and after even more millions have been spent by American business concerns relying on the permanent assistance of such branch banks, that unwise legislation should be allowed to hamper shipping, the third great spoke in the foreign trade wheel. Banking, merchandising and shipping are so closely dependent on each other's prosperity, in the foreign field at least, that no one of the three can be truly satisfactory if the rest are not. Capital invested in ships must be allowed to earn a reasonable return, but the ship operators cannot earn such a return unless there is a bona-fide effort on the part of Congress and the Government in general to co-operate in assisting it.

If a sound and workable shipping policy can be devised and quickly brought into operation, American exporters will start in the post-war business race on an even basis with their foreign competitors. The banks have done their part; branch banks are already open for business in every important commercial center throughout the world. What is now needed is a little better teamwork; with that assured, American foreign trade need not worry about retaining an adequate share of the business of the world.

The American Marine Insurance Syndicates

Marine insurance is a very important factor affecting the success of our merchant marine and overseas commerce. Its purpose is to protect our shippers, shipowners and other interested parties against losses which may occur through any of the perils connected with water transportation. It is a safeguard to commerce and exerts a powerful influence in shipping and banking transactions.

ENGLAND leads the world in marine insurance as she does in shipping and shipbuilding. Great Britain recognized long ago the importance of developing insurance along with its shipping and banking facilities not only at home but in every trade center. Insurance companies have been allowed and encouraged to combine into large syndicates and pools and have been permitted to write all kinds of insurance which enables them to reduce overhead charges, to enlarge their underwriting facilities and to meet all the requirements of a client. They are allowed to co-operate with banks through interlocking directorates, and English bankers have arrangements with insurance companies whereby they can provide insurance for their clients. England has also aided marine insurance by not imposing unreasonable taxes, and as a result has reaped the benefit of the intelligent policy that her shipping, banking and insurance interests have pursued through a proper association of their business interests.

AMERICAN MARINE INSURANCE

The principal obstacle that has prevented the growth of American marine insurance has been the conflicting and harsh laws of the numerous states. Some of these laws were made considering only the regulations thought necessary for fire insurance without taking into account the fact that marine insurance is vitally different. Again, other restrictions were made at a time when it was thought necessary to protect the public against schemes and practices that are now obsolete.

The principal restrictions referred to above should be corrected as follows, viz.: (1) American companies should be allowed to write all forms of insurance excepting life, so that one company could accommodate the full requirements of any

client, including casualty, compensation, protection and indemnity; (2) the system of taxation should be based on net profits rather than on gross premiums, as this system is not equitable and does not take the various losses that are bound to occur into account; (3) there should be uniformity in the insurance laws of the several states so that there would not be a multiplicity of conflicting regulations; (4) the laws regarding American companies doing business abroad should be modified to properly recognize the deposits that have to be made in foreign countries and the money that is due them from foreign reinsurers; (5) American companies should be permitted to enter into proper pools, syndicates or combinations, as marine insurance is an international business. The Federal Government has recognized this and the states should follow.

THE AMERICAN MARINE INSURANCE SYNDICATES

An epoch making and radical departure in American marine insurance practice was started when the American Marine fire insurance without taking into account the fact that marine and co-operation of the United States Shipping Board on June 28, 1920. These syndicates represent an effort to form a distinctly national policy, and for the first time American companies have combined to maintain a comprehensive service in insurance matters including inspections, surveys, etc. The following is an outline of the principal features of the three newly organized syndicates.

SYNDICATE A

Syndicate A (Service Syndicate) was organized to perform, at cost, surveying, inspection and loss surveys for the United

States Shipping Board in respect to all steel vessels owned by the board or sold by it on a part payment basis, and to perform similar service in respect to any vessels for any other shipowners and marine underwriters upon payment of reasonable charges for such service. The syndicate shall create and maintain an organization for inspection, and damage and loss surveys, and to advise all interested parties with respect to matters relating to inspection, repair, equipment, loading, management, operation, efficiency, safety and damage to, and salvage and loss of, vessels. It is not the intention, however, that this syndicate is to take the place of or perform the work of a classification society. Vessels are to be inspected approximately every four months, and the maintenance inspection shall show the condition of hull, machinery, galley, crew's quarters, and all parts of the vessel. Membership is limited to strictly American companies, but is open to all such companies as meet reasonable conditions of solvency and fair dealing.

SYNDICATE B

Syndicate B was organized to insure all American steel steamships which the United States Shipping Board may hereafter sell to others, to the full extent of the unpaid purchase price thereof, and also, to a like extent, such other American steel steamships heretofore sold by the board as are acceptable for insurance to the syndicate. The syndicate is to have an underwriting capacity of not less than \$2,000,000 upon a single hull. Every company subscribing to the syndicate has allotted to it a definite percentage of every assumed risk accepted by the syndicate underwriter. Rates of premium and policy forms may be altered as conditions require upon 10 days' written notice to the Shipping Board. The liability of the companies is several and not joint. Membership is limited to strictly American companies, but all such companies are acceptable if they meet reasonable standards of solvency and fair dealing. The subscribing companies agree to reinsure only with strictly American companies.

Since the operation of this syndicate is limited to the insurance of the Government's interest (the unpaid portion of the purchase price) in vessels sold by it, it follows that as the various installments of the unpaid purchase price are paid the Government interest in the vessels protected by this syndicate will decrease, while the private interest of the owners will proportionately increase. Syndicate B will therefore be a gradually diminishing syndicate, whereas syndicate C will be a growing syndicate.

SYNDICATE C

Syndicate C was organized to insure all American ocean-going steel hulls when approved and accepted for marine insurance by the syndicate managers, and owned by private persons or corporations or in which they have an insurable interest. The syndicate has a total underwriting capacity of not less than \$2,500,000 upon a single hull. The liability of all subscribers is several and not joint, each subscriber being committed in respect to each policy insured by the syndicate underwriter for the subscribing member's preagreed percentage written opposite its name on the list of subscribers.

Membership is divided into two groups. One group, representing at least two-thirds of the amount underwritten on any risk, consists entirely of strictly American companies; that is, companies chartered under the laws of the United States or of any state thereof, domiciled therein, and not controlled by foreign interests. The second group, representing not to exceed one-third of the underwriting capacity of the syndicate, shall consist solely of subscribing companies of foreign countries duly authorized and licensed to transact marine insurance in the United States.

Each syndicate subscriber may accept additional insurance on American hulls, outside of the syndicate arrangement, but

cannot do so at rates lower than those quoted by the syndicate. Nor can such additional insurance be reinsured in part or in whole outside of the syndicate, unless the syndicate declines to accept the business; nor shall such additional insurance diminish the underwriting obligations of such subscriber as a member of the syndicate.

MATTERS NOT COVERED BY SYNDICATES

Syndicate A is not allowed in any way to perform the work of a classification society, and neither Syndicate B or C may take cargo insurance. It is not intended to accumulate or invest the funds of Syndicates B or C, but to distribute the premiums as promptly as possible.

MEMBERSHIP

Membership in Syndicates A and B is limited to American owned and controlled insurance corporations, but membership in Syndicate C is open to foreign admitted insurance companies to the extent of one-third the underwriting interest, the other two-thirds being reserved to American companies. It is intended that membership in the syndicates shall be open to all qualified insurance companies and that the liability of each company shall be limited to the extent of the proportional share that each subscriber has agreed to assume in each syndicate.

MANAGEMENT

The three syndicates are to be managed by a single board composed from the representatives of nine subscribers, two of whom are representatives of foreign companies admitted to Syndicate C. An increase in the number of managers in order to give a wider sectional representation and the appointment of the manager of Syndicate A as an *ex officio* member is now under consideration. The chief underwriter is now an *ex officio* member and the United States Shipping Board has also the right to appoint an *ex officio* member who may attend those meetings of the board of managers that are held in respect to the affairs of Syndicates A and B.

The board of managers and the periods for which each member thereof shall continue in office are:

Subscriber	Representative	Term, Years
Home Insurance Company....	Louis F. Burke	1
Boston Insurance Company...	William R. Hedge	1
London & Scottish Assurance Corporation	Douglas F. Cox	1
Atlantic Mutual Insurance Company	Walter W. Parsons (vice-chairman)	2
Globe & Rutgers Fire Insurance Company.....	Edwin C. Jameson	2
Aetna Insurance Company.....	Samuel Bird, Jr.	2
Insurance Company of North America	Benjamin Rush (chairman)	3
Continental Insurance Company	Gomer H. Rees (secretary)	3
Sea Insurance Company.....	Hendon Chubb	3

Mr. Lawrence J. Brengle, formerly with Johnson & Higgins, and later with the Insurance Company of North America, is chief underwriter. Mr. Charles R. Page, formerly with the Firemen's Fund Insurance Company, and during the war a member of the United States Shipping Board, from which he resigned shortly after the armistice to become treasurer of the Atlantic Gulf and West Indies Steamship Lines, later becoming vice-president in charge of the operations of the Clyde and Mallory Steamship Lines, is manager of Syndicate A.

OFFICES

The head office of the syndicates is located in the Southern building, Washington, D. C., but the operating and underwriting headquarters have been established in the principal branch office at 44 Beaver street, New York, N. Y.

At the New York office Syndicate A maintains the headquarters of the North Atlantic district, which comprises all ports from Eastport, Me., to the Delaware River, inclusive.

(Concluded on page 48.)

Ships and Their Construction

Review of Present-Day Merchant and Naval Types of Ocean-Going Vessels

BY C. H. PEABODY, DR. ENG.

IN reviewing the construction of ships we may say, in the first place, that the steamship has got its growth; the great liners are not likely to be much exceeded in size and power in the immediate future, if ever. Ten years ago Sir William White, in giving a description of the *Lusitania* and *Mauretania*, said that there was no advantage in increasing size *per se*. Those ships could make their twenty-five knots week in and week out in all ordinary weather and run on schedule time as inferred by the phrase, "the Atlantic ferry." Even in heavy weather they were limited in power and speed only by the necessary consideration for the crew and the deck fittings; it is not desirable to carry away lifeboats and ventilators, nor to lose too many of the crew. Since their days, larger and more luxurious ships have been built, like the *Titanic* and the *Gigantic* and the great German liners, but they have less speed. The conditions of their design and construction were economic—what would pay in freight and passenger accommodations.

In another sense, the construction of steamers may be considered to have reached maturity in that shipbuilders are ready to meet any contingency that may arise should there be a demand for greater size or speed.

NORTH ATLANTIC NOT ALONE IN RACE FOR PASSENGER SERVICE

Since the North Atlantic has been the field for the race in the construction and speed of ships, we are likely to forget that a like or even a relatively greater development in steamer accommodations has been made on other waters—the Pacific, the Cape route and to South America. Large and commodious steamers are plying on these routes and at good speed. It must not be forgotten that even sixteen knots is a respectable passenger speed over the larger part of the ocean.

There has been recently a notable increase in large and relatively fast freighters; not so much the increase in size of the individual ship, for large ships, principally for freight, have long been common on the Atlantic. Such ships usually carry passengers, but that is a secondary consideration in ordinary times. Special types like oil tankers have shown most notable growth.

GROWTH OF TANKER TONNAGE

In a recent meeting of the Society of Naval Architects and Marine Engineers a description was given of a 20,000-ton tanker, with an incidental claim that it was the largest built. This claim was challenged and it appeared that the question, which was the greatest ship, depended on how you reckoned size.

The much discussed fabricated ship appears to have left the field of practical ship construction; it was an emergency measure to meet war conditions and served its purpose.

There is a difference of opinion concerning the ships fabricated during the war; perhaps there is a difference in the ships. The general opinion appears to be that they are rough but serviceable. The case against the fabricated ship has been thus stated by a noted shipbuilder, "A ship is pointed at both ends, and the ends are not alike."

MANUFACTURING OF SHIPS

As to manufacturing ships, that is a question of specialization and numbers. In American yards everything has been taken from battle cruisers to car floats. Some yards have built locomotive boilers—real locomotive boilers—not boilers

of the locomotive type. There has been much criticism that yards have given precedence to commercial work and let naval work drag, but during the war the shipyard was found to be (next to ships) the most precious national possession, and yards were hurriedly built with enormous waste. The shipbuilders would be the last to claim it, but the fact is that the maintenance of a shipyard by any device was a patriotic accomplishment. Of course, the builders were in the business to make money, or to try to make it.

But to get back to manufacturing ships. The great shipbuilding nation, Great Britain, has long specialized, some yards building certain types and other yards building others. Some yards had a monopoly of building for certain lines of steamers, a monopoly due to good service and good understanding. The company merely said, "Build me another ship." It might be like or different—the details were the affair of the builder. Even with a degree of specialization it cannot be said that ships were manufactured unless it be of a certain yard building so-called turret steamers, which, by the way, were not properly turreted, for turrets, whether on a castle or a warship, are round, and the steamers mentioned carried a high and narrow deck right fore and aft. But the type of steamer was unimportant; the important matter was that the shipbuilding company chose a type and certain limited sizes and went on building them whether there were orders or not. Everything was arranged for expeditious construction. The ordering and reception of material, working and transportation of material in the yard, launching and fitting out—all went on systematically. Every six weeks a ship was launched, and as soon as one ship took the water, material already prepared was brought onto the slip for the keel of the next ship. To such an extent was the construction manufacturing, that the yard had scarcely any drawing room force. That is the way to manufacture ships. Somewhat the same thing was done by an American yard during the war for destroyers, which were all of one type and built in bunches of five. Whenever and wherever ships are wanted in bunches they can be manufactured.

THE WOODEN SHIP HAS HAD ITS DAY

During the war there was a turning back to wooden construction in order to get more and more ships without waiting till the rolling of plates and shapes could catch up with orders. These ships are now for sale with no bidders. Except for small construction and special service, the wooden ship has had its day. It is a fair guess that a wooden ship will hereafter have its keel in one piece and that ships that are longer than such construction makes possible will be made of steel. As for the concrete ship, it may be said to have "died abornin'."

WARSHIPS

Though it may be too soon to speak with confidence, it appears that the war has shown the relative importance of warships to be in the order of battleships, destroyers, battle cruisers, submarines, transports and cruisers. The sea was, and probably will be, dominated by the battleship that can give and take hard knocks. The fact that there was no conclusive action between battleships proves only that the weaker party had discretion. A fleet-in-being is always a danger until it is destroyed or surrendered. The destroyer, preferably as big and as fast as possible, is to the modern fleet what the frigate was in the days of three-deckers—the attendant,

the scout and the screen. The other services, especially in conveying, were most prominent in the late war because the battle fleets spent most of the time in reserve; really, the convoy duty should be by ordinary cruisers or even armed merchantmen.

Probably the real duty of the so-called battle cruiser is to sweep the seas of enemy craft so that commerce may be safeguarded. They can drive away or destroy all ships but battle-ships, but they cannot stand up under heavy fire.

At one time it appeared that the submarine would win the war; it was a new weapon against which the defence was not yet found. Even if the barbarity of sinking merchantmen without warning should be accepted as a necessary part of some future war, that war will not be won by the submarine.

IMPORTANCE OF MERCHANT VESSELS IN WAR

The importance of merchantmen, and especially of large and fast passenger ships for transports, was the real lesson of importance for our country. A war may be decided by the navy or even by a single naval action. This truism goes back to the battle of Salamis, for Xerxes did not go home because he was a coward, but because the game was up when his line of transportation for his great army was destroyed. But generally a war is determined by the foot soldiers, and we need ships that can carry our soldiers where they must go to end a war. In many cases the threat will be sufficient perhaps before the war has begun. Cruisers are put at the end of the list because it cannot be expected that they will decide a war. The old chivalric tacit agreement that frigates should not be fired on if they would only keep out of the way might well be extended to cruisers which should chance into a main action. A cruiser is, however, a man of all work in peace and war, and perhaps it should not be relegated to the last class of warships.

No mention has been made of airships or airplanes. Under certain conditions they may be of great value as scouts or for locating submarines or mine fields; as a weapon against ships they have accomplished nothing. It is possible to drop bombs from either airships or airplanes on or near a city.

All the types of ships have reached their growth, unless perhaps it may be submarines. At least this is to be hoped for, where our latest battleships of 42,000 tons displacement and 23 knots speed carry twelve 16-inch guns and our battle cruisers have 34,800 tons displacement and 35 knots speed and carry ten 14-inch guns. Our later destroyers laid down are to have a speed of 35 knots, the same as the battle cruisers; they cannot hope to maintain such a speed in rough weather as can the cruisers. As for the submarine, it properly depends on the internal combustion engine and is a small and feeble craft, depending on stealth. One British "fleet submarine" having steam turbines to give a speed of 24 knots has had its trials; what its scope and duties may be does not yet appear.

PROPELLING MACHINERY

Coming now to the propulsive machinery, we have steam engines, steam turbines and internal combustion engines, together with mechanical and electrical gearing; the latter is known as the electric drive.

The old reciprocating engines came to maturity forty years ago and there has been no material change except increase in size; now it is threatened by the steam turbine and the internal combustion engine.

The marine steam turbine is the ideal propelling engine for a ship. It is the designers' and the builders' machine, shut up in a box and requiring intelligent care to see that it remains in line with its clearances intact; also the lubrication must be continuous and sufficient. The direct turbine drive of large passenger ships appears to be completely worked out, as is also the geared turbine for destroyers and the double geared turbine for freighters. Many geared turbines for freighters, hurriedly built and installed during the war,

have given trouble, which has not been less in the hands of hurriedly trained crews. Now such machinery by good builders can be depended on if intelligently cared for.

The electric drive was invented to maintain reasonable economy on warships at cruising speeds. That purpose it accomplishes admirably, and perhaps the success of our battle cruisers may be conditioned absolutely on the electric drive.

Both mechanical gearing and the electric drive find an ideal motor in the turbine with its high speed and uniform torque. A double geared steam turbine has a curious appearance, with the gears larger and many times as heavy as the turbine itself. The gears, like the turbines, are the builders' machine and call for little but intelligent care from the engineers to see that they are kept in alinement and in proper gear and that they are properly lubricated.

DIESEL ENGINES AND THE MOTORSHIP

The internal combustion engine, of either the Diesel or the hot bulb type, has been completely adapted to sea service, with standard methods of building, installation, operation and maintenance. The auxiliary service is not yet completely standardized, it being uncertain whether it is best to have a donkey steam boiler to work auxiliaries directly by their own internal combustion engines or to install a general electric system using internal combustion engines. There appears to be no controlling objection to steam auxiliaries either burning oil or carrying coal for that purpose. The ideal system appears to have a sufficient electric plant for all purposes except propulsion, including heating and cooking. The Diesel engine, having a supply of compressed air, can use it for various auxiliary purposes. The hot bulb engine can be made of all sizes and is now adapted to hoisting and pumping.

In order to reduce weight, the Diesel engine is run at higher speed than that desired for best economy of the propeller. Whatever disadvantage comes with smaller diameter and less pitch ratio is accepted as a slight offset to the great advantage of excellent fuel economy. Both ways of reconciliation that have been applied to steam turbines are under consideration, namely, gearing and the electric drive. While the turbine is well adapted to driving through gears, the internal combustion engine is not, on account of its irregular torque and the dynamic forces acting on the pistons. The electric drive shows possibilities; the gain in propeller efficiency will probably be more than the loss through electric transformation, and the maneuvering of the ship and arrangement of auxiliaries will be simplified. It will be possible to have as many engines as can be conveniently carried, all of which can drive a single screw or twin screws.

INCREASING THE POWER OF DIESEL ENGINES

The real question of the internal combustion engine is to provide more power. Though certain European builders are ready to contract for engines to deliver 500 horsepower per cylinder, it is not known that any are in service. The difficulties are thermal and are likely to develop in service; if not now met they probably will be. Now the ideal internal combustion engine has six cylinders, so that it may be completely balanced; six cranks are surely enough for any engine. At present the power per cylinder is not much more than 300 horsepower, so that a six-cylinder engine may give 2,000 horsepower; with twin screws double that power can be used conveniently.

By far the greater number of freighters may be driven by internal combustion engines as now built. As already suggested, electric drive is well adapted to gear up this ideal engine with the best propeller, and if three or four engines can be installed the range of power can be just so far extended. Even so the range of power is limited and the great ships are likely to remain steamers. Incidentally, an electric drive would provide at the same time for all auxiliaries.

Electric Ship Propulsion

Comparison of Electric Propulsion With Geared Turbine Drive in Merchant Vessels

BY W. L. R. EMMET*

THE advantages afforded by the electrical method of ship propulsion are largely dependent upon conditions and specific cases must be studied in detail in order that just comparisons with other methods may be made. For example, in large battleships there is a very great advantage in interchangeability and adaptability to economic operation under widely different conditions of service, also a greater safety and convenience in arrangement in the ship without any disadvantage in weight or space occupied, while in such a vessel as a high power destroyer limitations both of weight and space would constitute almost prohibitive disadvantage.

The argument for electric drive in large warships may be said to have been concluded after many years of controversy by its general adoption by the United States Navy in the vast building programme now in progress and by its unqualified success in the battleship *New Mexico*.

In merchant ships the advantages are less obvious and less generally admitted and are, therefore, most worthy of careful study at the present time; and the comparison which is most important for present needs is that between the electric propulsion from steam turbines and the application of steam turbines by means of mechanical speed reducing gears.

While the Diesel engine is being extensively applied to ships, it is obvious that the extent and scope of its use are limited, and, since the bulk of production is of steamers, we may justly confine our present study to the comparison just stated, although electricity has also been used in transmission to propellers from Diesel engines.

PROPELLING EQUIPMENT

In applying electric propulsion to a merchant ship we install one or more steam turbine generating units. Large turbines are more efficient than small ones. Therefore, while two or more turbines may be convenient on account of the ability to run with one alone, it is often more advantageous to run ships of moderate power from a single turbine. As will be explained, arrangements can be made by which such a ship can be driven at a reduced speed from the auxiliary generating units in case the main apparatus cannot be run. In such single generating units we can generally adopt such speed as will give the best results for the power delivered, and the freedom to do this is of great importance, since a turbine is more complicated and expensive and materially less efficient if it has to be designed for a speed less than is desirable.

On each propeller shaft a motor, preferably of the synchronous type, will be installed, so designed as to give the most advantageous propeller speed. The first electrically driven ships were equipped with induction motors, but synchronous motors are lighter, more efficient, run with a larger clearance and can be built to give the full reversing torque required and to accomplish all the required functions.

AUXILIARIES

In addition to the generating and motor equipment, it is desirable to establish an efficient auxiliary generating plant with at least one spare unit. The auxiliary units should preferably be steam turbines, geared to direct current generators, and their power should be used for exciting the main generators and motors, running as many of the ship's auxil-

iaries as possible by motors and lighting the ship, etc. These units can be run condensing and be so arranged that they can exhaust either into the main or auxiliary condensers. Any steam driven auxiliaries which might be employed should be exhausted into the feed heater, and additional steam, which may be required for feed heating, can be advantageously taken from an intermediate stage of the main turbine.

This auxiliary plant can be used to propel the ship, either using a motor generator set to turn its direct current into alternating of suitable frequency for use in the main motors at low speed, or a direct current motor can be installed so that, if necessary, it can be put into engagement with the propeller shaft by a simple spur gear carried on the shaft for the purpose. The latter arrangement would generally be the simpler and cheaper. Such arrangements, of course, have no functions in larger ships which can be advantageously run with two generators. And, in fact, it may be considered an unnecessary addition, since the properly equipped electric ship, even with a single generator, is more reliable than any other form which uses a single propeller.

POSITION OF APPARATUS

In the electrically driven ship the generating plant can be put in the most convenient position with respect to the boilers, and at any convenient level, and the motors can be put as near the propellers as the form of the ship permits; thus, in many cases, saving weight and space for shafting and shaft alleys and also the friction of shaft bearings.

GEARED TURBINES

The other method of ship propulsion, of which the value should be compared with that of electric drive, is the combination of turbine and gearing. In attempting to make this comparison, it must be remembered that gears have been applied to this purpose in a number of different ways involving various advantages and disadvantages.

The first ship gears produced were of the single reduction type and used, on account of gear conditions, turbines much lower in speed than is considered desirable for other uses, such as the driving of electric generators. Later, in this country, the General Electric Company introduced double reduction gears for ships with speeds considered most desirable both for turbines and propellers, and with a consequently more complicated gear arrangement. Following this lead, double reduction gears were produced to meet the war emergency by all the large American producers, and later a number of English makers went to the double reduction type at the same time that some American makers were changing back to single reduction.

There have been many troubles with ship gearing and many theories as to the causes of these troubles which will not bear comparison with the facts. The General Electric Company has built more ship gears than any other manufacturer, with the possible exception of the Westinghouse Company, and we have kept careful track of troubles with gears including many of different makes. Our observations indicate that there is still great uncertainty in the gear situation and that there is no type of gear which has, in all cases, given reliable service.

In deciding upon the relative merits of gear and electric drive, it is obviously desirable that causes of troubles in gears

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be proved with some degree of definiteness and consistency. There has been much theorizing on this subject which will not bear comparison with the facts and some definite experimentation which deserves careful consideration.

POSSIBLE CAUSES OF FAILURE IN SHIP GEARS

While, undoubtedly, many such gears have failed through neglect, improper lubrication or improper installation, there have been a great number of failures to which no such causes can be assigned. It has been repeatedly proved by experiment that similar gears on shore will bear, without deterioration, loads as much as four times as great as those which have caused rapid failure with perfect installation and care on ships.

Tests have been made with a torsion device between a ship gear and the propeller which showed periodic increases of torque as high as 50 percent through influence of ship's motion and waves upon the propeller. This was in a moderate sea pitching 4 degrees, and such effect may be much greater under some conditions, but cannot account for such differences of performance at sea and on shore as have been stated.

Another test has been made which may throw much light upon a possible reason for such excess pressure on the engaging surfaces of gears as might cause the pittings and destructions observed. A light, stiff arm was attached to a bearing cup at the middle of a ship gear, with multiplying devices to show relative motion between the ends of this arm and the corners of the gear casing which carry the other bearings. Obviously any movement here shown indicates a springing of the structure and a variation in the alinement of the bearings.

The tests made with this device showed various degrees of movement under different conditions and directions of the sea. With a rough sea directly following there was practically no movement, while with a rough, quartering sea an amplitude of movement as great as .05 inch was observed. While the method of measurement may have somewhat magnified the actual distortions of the gear casing, it is obvious that even a fraction of such movements might account for immense increases of pressure on points of gear engagement. The marked effect of direction of the sea in these tests explains the possible reason why ship gears suffer heavily on certain voyages and not on others.

EFFICIENCY OF GEARING ON SHIPS

Many claims of very high efficiency for ship gears have been made, but few of these have been based upon properly conducted test data. The General Electric Company has conducted several careful tests of ship gears accurately set up on shore and run at various speeds and actually transmitting power up to full load. Under these conditions the operation was perfectly smooth and practically noiseless, and the efficiency must have been better than that at sea with possible variations of pressure in gears and bearings.

These tests show that gears are much more efficient at heavy load than at light load and that at low tooth speed the efficiency is better than at high. Thus, if we adopt very conservative designs which give low tooth pressures we get relatively poor efficiency, and if we use high turbine speeds and gear speeds the efficiency of transmission is relatively low.

As experience has developed, gears have been made larger and larger with lower tooth pressures and it cannot be positively said whether the end of such increases has yet come. But, on the basis of standards which have recently been adopted, these tests indicate that, even under test conditions, the double reduction gears now being produced should not be more than 94.5 percent efficient. In this connection it should also be remembered that careful tests have shown that reversing turbines, designed for good torque, introduce losses ranging from 1 percent to 1.5 percent. There are also additional packing and other losses, if high and low pressure tur-

bines instead of a single turbine are used, which is the general present practice in geared ships.

Single reduction equipments, as generally applied, are more efficient in gear transmission—possibly 97 percent—under most favorable conditions with conservative pressures, but there are few cases in commercial ships where single reduction can be used without sacrifice in the quality of the turbines.

Thus, under most favorable conditions, the net efficiencies comparable with electric transmission are not better than 93.5 percent for double reduction and 96 percent for single reduction, including reversing losses, etc. Electric transmission will give about 92.5 percent for small powers and 95 percent for large powers. This small difference will certainly be more than equalized—probably very much more—by the irregularities of gear operation at sea as indicated by wear and pitting and by loud noises emitted in rough weather.

MECHANICAL CONDITIONS IN ELECTRIC PROPULSION

In electrically driven ships we have no motion but simple rotation and no mechanical engagements except in the bearings. Propellers are free to revolve whether their motors are in repair or not.

Generators and motors of the type and voltage used for such work are practically immune from mechanical or electrical failures and are very simple to repair, either permanently by putting in new coils or temporarily by reconnecting so that they can be run at reduced load. As has been said, arrangements can easily be made by which a ship can be run from auxiliary turbines, if all the main apparatus should be inoperative. A ship having two generating units can be run at about three-quarters speed with one of them and the efficiency of operation at this reduced speed is very nearly as good as that at full speed.

Designs have been worked out by the best experts for ships of different types, including large liners, which, considering all these conditions, show great advantages over gear driven equipment, and it may be confidently expected that electric propulsion will, at an early date, play a very important part in merchant marine activities.

New Wireless Regulations for Vessels Entering British Ports

AMERICAN shippers should note that hereafter all vessels arriving at British ports will be subject to the provisions of the British Wireless Act of 1919, which requires that every seagoing passenger steamer or ship of 1,600 gross tonnage or upwards shall be provided with a wireless telegraph installation. The installation will be expected to comply with the requirements of the International Radiotelegraph Convention of 1912 as modified by international agreement.

The new act stipulates that ships not engaged in the coasting trade carrying 200 persons or more must carry three operators on voyages exceeding 48 hours from port, on voyages exceeding 8 hours but not exceeding 48 hours two operators, and on voyages not exceeding 8 hours from port to port one operator.

In the United States the first act requiring wireless apparatus on certain passenger carrying vessels was approved in June, 1910. The second act, approved in July, 1912, amended the first act so as to cover all vessels navigating the ocean or Great Lakes and licensed to carry 50 or more persons, including passengers or crew, with the exception of steamers plying between ports or places less than 200 miles apart.

This act also requires an auxiliary source of power independent of the vessel's main electric power plant, which will enable the sending set to send, for at least four hours, messages over a distance of at least 100 miles.

Motorship Building in the United States

Although the aggregate tonnage of motorships building in the United States at the present time is only about one-tenth of that under construction in Europe, nevertheless a start has been made towards developing a motorship fleet in the United States, and it is generally acknowledged that most of the larger shipbuilders are preparing to engage in this type of construction whenever the market for this type of vessel appears to justify such a move. Details of the vessels actually under construction and of the various types of engines which are now being built in this country are given in this article.

THE year 1920 marks the real beginning of motorship building in the United States. At the present time there are nineteen motorships, totalling 143,850 deadweight tons, under construction in this country, the total shaft horsepower for these vessels amounting to 44,520. In addition, there are twelve or fifteen vessels now being reconditioned as motorships in American repair yards. Sixteen firms are actually building Diesel engines and twelve other firms, including some of the large shipyards, either have licenses for building Diesel engines of foreign design or are carrying out experimental work on original designs of Diesel engines.

MOTORSHIPS UNDER CONSTRUCTION

By far the largest order which has been placed for motorships in the United States is that for four ore carriers each of 20,000 tons deadweight capacity to be built for the Ore Steamship Company, New York, by the Bethlehem Shipbuilding Corporation. These vessels will each have a set of two 2,500 shaft horsepower two cycle Bethlehem-West type six cylinder direct reversible marine Diesel engines. These engines are in every respect similar to the one installed in the ore carrier *Cubore*. The speed of these vessels is estimated at 11½ knots.

At the Gloucester, N. J., yard of Pusey & Jones the motorship *William Penn* ordered by the United States Shipping Board is nearing completion. This vessel has a deadweight capacity of 12,900 tons, a length of 439 feet 3 inches, a beam of 60 feet and a depth of 30 feet 8 inches. Propulsion is by two sets of original Burmeister & Wain six cylinder four cycle 1,750 shaft horsepower direct reversible Diesel engines purchased abroad by the Shipping Board and installed by William Cramp & Sons Ship & Engine Building Company, Philadelphia. These engines will run at a normal speed of 110 revolutions per minute.

The *William Penn* was launched about two months ago and will be ready for service early in 1921. She will be put in a competitive test on a Far East run with the first electrically driven steamer, the *Eclipse*, so as to gain comparative data of cost and reliability of operation.

Two motorships of 11,200 tons deadweight capacity for the American Hawaiian Steamship Company, New York, are under construction at the Chester (Pa.) yard of the Merchant Shipbuilding Corporation. Each of these vessels will be driven by two Burmeister & Wain Diesel engines similar to those installed on the *William Penn*, but they will be built by William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa. These vessels will have a length of 445 feet, a beam of 59 feet 8 inches, a depth of 39 feet and a speed of 11½ knots. As is the case with the *William Penn*, the deck auxiliaries will be electrically driven.

The Union Construction Company, San Francisco, Cal., is building for the Standard Oil Company the Diesel engined tanker *Charlie Watson*, which has a deadweight capacity of 5,050 tons and is propelled by two Skandia Werkspoor Diesel engines of 850 shaft horsepower each running at 135 revolutions per minute. The vessel will have a speed at full load of from 10 to 12 knots. Another tanker of 2,800 deadweight tons is also under construction for the Standard Oil Company at the yard of the Moore Shipbuilding Company, Oakland,

Cal. This vessel, the *F. H. Hillman*, is 342 feet long, 46 feet beam, 27 feet depth and will be driven by two 500-horsepower Werkspoor Skandia engines running at a speed of 165 revolutions per minute, giving the vessel a speed of 10 to 12 knots.

At the Newark Bay yard of the Submarine Boat Corporation, New York, a 10,000-ton motorship is to be built, which will be driven by one Craig engine of 2,500 indicated horsepower built by the James Craig Engine and Machine Works, Jersey City, N. J.

Seven 600-ton deadweight concrete tankers are being built for the United States War Department at the Newport Shipbuilding Company, New Bern, N. C., each of which will be equipped with two 450 shaft horsepower 8 cylinder Winton engines running at a speed of 210 to 220 revolutions per minute, giving the vessels an estimated speed at full load of from 13 to 14 knots.

A contract has recently been placed with the Todd Dry Dock & Construction Company, Tacoma, Wash., by the Alaska Steamship Company for a 6,500 deadweight ton cargo carrier to be equipped with two 900-horsepower McIntosh & Seymour crosshead type Diesel engines running at 135 to 140 revolutions per minute. The length of the vessel will be 345 feet, the beam 49 feet 6 inches and the molded depth 26 feet 9 inches.

The Long Beach Shipbuilding Company, Long Beach, Cal., has under construction the yacht *Edythe*, 125 feet long, which will be driven by two 360 shaft horsepower Nelseco Diesel engines supplied by the New London Ship & Engine Company, Groton, Conn.

MOTORSHIPS IN COURSE OF RECONSTRUCTION

At the Vulcan Iron Works, Jersey City, N. J., the motorship *Bacoi* owned by L. G. Gillespie & Son, New York, is being changed from a typical Lake boat into a standard cargo carrier. The original Polar engine will be replaced by a pair of 500 shaft horsepower six cylinder four cycle McIntosh-Seymour direct reversible marine engines. The boat will enter service early in 1921.

The motorships *Astmacco III* and *IV*, which have been acquired from the Shipping Board by the Astoria Mahogany Company, New York, were originally built by the Manitowoc Shipbuilding Company, Manitowoc, Wis., and equipped with two 340 shaft horsepower two cycle hot bulb engines of the Bolinder type, but the guaranteed speed of 9 knots has not been obtained and so the owners have decided to recondition the ships with a set of Diesel engines throughout so as to enable them to run at a speed of at least 10 knots. For this reason both of these boats are to be fitted out each with a set of two McIntosh-Seymour four cycle direct reversible marine Diesel engines of 500 horsepower. These vessels are scheduled to enter service again as full powered motorships at an early date.

The New London Ship & Engine Company, Groton, Conn., has under reconstruction for their own account several old torpedo boats from the United States Navy which may be converted to passenger motorships in the coastwise trade. Each will be equipped with two Nelseco engines.

The Staten Island Shipbuilding Company, New York, has

been entrusted with the reconditioning of five auxiliary schooners of the *Starlite* type to full-powered motorships retaining the actual power plant consisting of two 340 shaft horsepower Bolinder engines.

DIESEL ENGINE BUILDERS

Among the American firms that are actually engaged in building marine Diesel engines are the following:

The Busch-Sulzer Diesel Engine Company, of St. Louis, Mo., has acquired the old American Diesel Engine Company, which was founded in 1898 and which was exclusive owner of all the original Diesel patents and rights for the United States. In 1911 the Busch-Sulzer Company was formed, which now owns all the patents of the former company, and, in addition, is exclusive licensee of the Sulzer Brothers, of Winterthur, Switzerland, for their four cycle and two cycle stationary and marine Diesel engines.

During the war this firm was very heavily engaged in the construction of submarine engines for the United States Navy, building engines ranging in capacity from 350 to 900 shaft horsepower of the four cycle as well as of the two cycle type. Recently this firm has built and had under a 30 days' test their first 750-horsepower two cycle marine type engine and are prepared to take future orders for any size of engines up to 2,000 horsepower.

The design of the Busch-Sulzer engines differs very little from the original Sulzer type and only such modifications have been made as to comply with American shop practice.

The New London Ship & Engine Company, Groton, Conn., was organized in 1911 and owns the M. A. N. patents for two cycle as well as for four cycle engines, but in spite of owning the rights to build one of the most successful European Diesel engines, this company has found it better to develop a type of its own and has brought out a Diesel engine under the name of Nelseco which is very different from the original German type. This firm was also very heavily engaged in war work for the United States Navy, as their engines, being of the high speed type, are exclusively used in submarines.

At the present time it appears that this company, which is affiliated with the Submarine Boat Corporation, will enter the merchant marine field and develop a two cycle double acting marine Diesel engine of about 1,250 shaft horsepower. This company is also a strong advocate of the Diesel electric drive.

MCINTOSH-SEYMOUR LEADS IN MERCHANT WORK

The McIntosh-Seymour Corporation, Auburn, N. Y., has the rights of the Swedish Polar engine built by the Swedish Atlas Diesel Engine Company, of Stockholm. This firm has also developed its own type of Diesel engine based on the Polar experience, but is exclusively building four cycle engines suitable for merchant marine purposes. This firm has shown the greatest activity in the merchant marine field and has more ships afloat equipped with Diesel engines than all the other companies in this country combined. Up to a short time ago they had been building only a trunk piston type engine, and in connection with the Shipping Board have developed a slow speed heavy duty merchant marine type of a capacity in six cylinders of 900 shaft horsepower running at a speed of 125 to 135 revolutions per minute. A 30 days' test of the first engine has apparently given satisfactory results, and it is rumored that twenty such engines have been ordered through the United States Shipping Board by the Pacific Coast Steamship Company for a fleet of ten motorships of about 6,000 to 7,000 tons. Also this company is prepared to supply engines up to 5,000 shaft horsepower as required in 10,000-ton ships at a speed of 11 to 12 knots.

The William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., has acquired the Burmeister & Wain license for the United States and has under construction for

the account of the American-Hawaiian Line of the United American Lines two sets consisting of four engines of 1,750 shaft horsepower for two 11,500-ton boats. These engines will be similar in every respect to those acquired by the Shipping Board some years ago direct from Burmeister & Wain and used in the United States Shipping Board's only motorship, the *William Penn*, which shortly will enter service in competition with the first electric driven cargo carrier *Eclipse* and used in the Far East service.

The Worthington Pump & Machinery Corporation, of New York, has for a long time been building horizontal stationary Diesel engines after the Koerting design which have been used mostly for pipe line work. During the war this firm developed a merchant marine Diesel engine similar to the Burmeister & Wain type for their own account. The first engine of this type has been put through a 30 days' full load test with apparently good results.

NEW BETHLEHEM-WEST ENGINE

The Bethlehem Shipbuilding Corporation, Bethlehem, Pa., has developed a two cycle engine type of its own, taking as a model the M. A. N. engines of the United States supply ship *Maumee* built some five years ago at the Brooklyn Navy Yard. This first Bethlehem engine is of the two cycle type with valve in head scavenging and develops a capacity of 2,500 shaft horsepower in six cylinders at a speed of around 100 revolutions per minute. This first engine has been installed in the ore carrier *Cubore* of the Ore Steamship Company, of New York, and the results obtained during the first trips of the *Cubore* were so satisfactory that the Ore Steamship Company has ordered four twin screw ships of 20,000 tons each to be equipped with a set of 2,500 shaft horsepower engines.

The James Craig Engine and Machine Works, Jersey City, N. J., has for many years been building a four cycle Diesel engine of its own design which has given in many instances very good results in yachts and service boats. Several units have been installed also in submarines of the United States Navy. This engine is of the column frame type with auxiliary exhaust valves at the end of the stroke in each cylinder, which arrangement should permit the use of very heavy grade oil, such as Mexican and Californian oils, both of which contain heavy percentages of either asphalt or sulphur. This firm has now under construction a 1,500 to 2,000 shaft horsepower six cylinder marine Diesel engine for the account of the Submarine Boat Corporation and it appears that this engine will be ready in a short time for installation in a boat of the Submarine Boat Corporation.

The Skandia Pacific Oil Engine Company, of San Francisco, Cal., is connected with the Swedish Skandia Engine Company, and up to a few years ago was engaged in the building of the Skandia hot bulb engine. About three years ago a Werkspoor license was acquired for the building of the Werkspoor four cycle marine Diesel engines and the company has developed and built under the supervision of the United States Shipping Board a set of two 825-horsepower six cylinder Werkspoor-Skandia marine Diesel engines. This type is quite a departure from the original Werkspoor column frame type and makes very extensive use of cast iron framing, which insures much greater steadiness on board ship. The company has orders on hand for several motorships for the Standard Oil Company.

The Winton Engine Company, Cleveland, Ohio, has developed its own type of high speed marine Diesel engines of the trunk piston type, basing its design on its large experience accumulated during many years of building of heavy duty gasoline marine motors. The engines are built up to 450 horsepower in eight cylinders with a speed up to 250 revolutions per minute. A number of boats, full powered cargo carriers, as well as two yachts, which are propelled by

Diesel electric drive, have been equipped with this type of propelling machinery.

The Nordberg Manufacturing Company, Milwaukee, Wis., is the licensee of Carel Freres, of Ghent, Belgium, for the Carel two cycle type stationary and marine engine. Up to the present time this firm has not been engaged in marine work and is only building engines for stationary purposes in the mining districts of the United States.

The Dow Pump & Engine Company, Alameda, Cal., has for several years built Diesel engines for stationary and marine purposes based on an English design and has several installations of 600 horsepower or more in operation on board ships with apparently good service.

The Manitowoc Shipbuilding Corporation, Manitowoc, Wis., about two years ago purchased the license of the Franco Tosi Company, of Legnano, Italy, but up to the present time has done very little in actual work, having built only one experimental 120-horsepower electric generating set which for several months has been in actual operation with very good results. This company has developed its own design of marine engine based on the Tosi experience and will begin in a very short time experimental work on two cycle single acting as well as double acting direct reversible marine engines.

The United Engineering Company, San Francisco, Cal., is also licensed to build the Franco Tosi marine Diesel engine on the Pacific coast, but up to the present time has done very little in actual Diesel engine work.

SOLID INJECTION TYPE DIESEL ENGINES

The firms who are building the solid injection type of Diesel engine are as follows:

The De LaVergne Machine Company, of New York, has for many years built a Diesel engine of its own design and a semi-Diesel engine of the Franchetti type. Lately it has built and tested out a vertical four cylinder solid injection type marine Diesel engine with very good results.

The Ingersoll-Rand Company, of New York, has taken over the rights of the Price Engine Company, of New York, and is prepared to supply Price engines in capacities up to 2,000 horsepower.

The Opposed Piston Oil Engine Company, of New York, has been formed to take over the old American Junkers Engine Company to build and grant licenses in this country for the Junkers type Diesel engine, which has been built in England by Doxford, of Sunderland, for many years and of which English company the Opposed Piston Oil Engine Company is also exclusive licensee in this country.

FIRMS CONSIDERING THE BUILDING OF MOTORSHIPS

Other companies who own licenses to build Diesel engines are the New York Shipbuilding Corporation, Camden, N. J., and the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., both of which have Werkspoor licenses. On account of urgent navy and merchant marine work no Diesel engine building has been undertaken by either of these firms, but it is probable that later on both companies will take up the construction of Diesel-engined motorships. In addition, the following firms are considering the building of motorships:

The Federal Shipbuilding Company, of Kearney, N. J.; the Moore Shipbuilding Company, Oakland, Cal.; the Long Beach Shipbuilding Company, Long Beach, Cal., which is on the point of concluding a license agreement to build at its own yard two cycle marine engines up to 1,000 horsepower per unit in four cylinders; the Great Lakes Engineering Company, Detroit, Mich.; the Ames Shipbuilding & Dry Dock Company, Seattle, Wash.; and the Bath Iron Works, Bath, Me.

The Westinghouse Electric & Manufacturing Company is considering the building of Diesel engines in connection with

electric generating sets for Diesel electric drive as well as for auxiliary purposes on board ships. The Ford Motor Company, Detroit, Mich., in connection with the Hooven, Owens, Rentschler Company, Hamilton, Ohio, is considering building Diesel engines for marine and stationary purposes. The Seattle Engineering Company, Seattle, Wash., has built an experimental engine of the four cycle type of its own design. The W. & A. Fletcher Company, Hoboken, N. J., is building a hot bulb engine of its own design for experimental purposes, and the Sperry Gyroscope Company, Brooklyn, N. Y., an experimental compound Diesel engine consisting of two high pressure four cycle cylinders and one low pressure cylinder working on the two cycle principle.

Merchant Marine of France

M. LE TROCQUER, M. Francois Marsal and M. Albert Sarraut, ministers respectively of public works, finance and the colonies of France, and M. Bignon and Thoumyre, under-secretaries of state for the mercantile marine and food supply, met on December 4 to draft a bill providing for the sale of the French national merchant fleet and the establishment of shipping lines with the colonies. The committee will be assisted by a technical commission to carry out the sale.

The ministers also considered modifications in the bill embodying a programme of merchant ship construction which has already been adopted by the Chamber of Deputies and is now before the Senate. The measure provides for an expenditure of over 1,000,000,000 francs (approximately \$60,000,000 at the present rate of exchange), while the new programme provides for expenditures amounting to 300,000,000 francs (approximately \$18,000,000 at the present rate of exchange) for building liners, 250,000,000 francs (approximately \$15,000,000) for building colliers already ordered by the Ministry of Industrial Reconstruction and for the payment of shipbuilding bounties already sanctioned.

The American Marine Insurance Syndicates

(Concluded from page 41.)

The headquarters of the Middle Atlantic district have been established in the Stewart building at Baltimore and include all ports from the Delaware River to Charleston. The headquarters of the East Gulf district are in the Orm building at New Orleans, with jurisdiction over Mobile and New Orleans and the headquarters of the West Gulf district are in Galveston, with jurisdiction over the ports of Orange, Beaumont, Houston and Galveston.

An organization on the Pacific coast will soon be established, and as soon as this is completed attention will be directed abroad and the first agency will probably be planted in England. From this point agencies will be appointed throughout Europe. After this agencies will be established in the Orient and South America.

MERCHANT MARINE CONVENTION.—The annual convention of the National Merchant Marine Association will be held at the Washington Hotel, Washington, D. C., on January 20 and 21. Included in the list of speakers at this meeting are leaders in shipping, railroad, export and import companies, agriculture, manufacturing, Government departments and prominent members of Congress. The Mississippi Valley Association and the South Atlantic Association have arranged to hold meetings on January 19 and 20 and will join with the National Merchant Marine Association in a joint programme for the promotion of United States shipping.

A Review of Motorship and Marine Diesel Engine Building in Europe

BY OUR SPECIAL LONDON CORRESPONDENT

The year 1920 has marked a revolution in the development of the motorship in Europe. It would seem that, almost without exception, shipowners have become converted to a belief in the advantages of the internal combustion engined vessel, and so strongly do some of them hold to this opinion that orders have been placed for batches of motor craft, in some cases contracts for as many as ten new ships being fixed. The position can best be explained, so far as Great Britain is concerned, from a statement of the fact that there are now thirteen of the leading shipbuilding and marine engineering concerns in the United Kingdom actually building marine oil engines on a commercial scale for installation in motorships, while four more are constructing their first experimental engine. These seventeen firms represent the cream of the shipbuilding industry, and those concerns which have not yet interested themselves in oil engine construction hold for the most part a second rate position.

DURING the year about twenty large motorships have been completed and the orders in hand in European yards now amount to between 180 and 190 ships, varying from vessels of 14,000 tons deadweight capacity to craft of 3,500 tons. There are, of course, many more motor vessels of smaller size being built, but these do not come within the scope of this review. The ships on order probably represent a deadweight carrying capacity of somewhere in the neighborhood of 1,500,000 tons, and as the majority of the contracts are for completion before the end of 1922, it will be seen that within two years there will be a vast fleet of European motor vessels trading throughout the whole world.

LEADING SHIPOWNERS BUILDING MOTORSHIPS

In Great Britain twelve of the leading shipowners, including the British India Steam Navigation Company, the Pacific Steam Navigation Company, the Royal Mail Steam Packet Company, the Glen Line, the Bibby Line, the Brocklebank Line, and Lamport and Holt, are having motor vessels built and the same tendency of the chief shipowning firms in con-

tinental countries is to be noted. For instance, in Denmark the East Asiatic Company, in Sweden the Transatlantic Company and the North Star Company, in Norway the Thoresen Line and the Olsen Line, in Holland the Royal Netherlands Steamship Company, in France the Chargeurs Reunis, and in Italy the Societa Nazionale di Navigazione, of Genoa, all have motorships under construction, and this is mentioned to indicate that few, if any, of the more important shipowning firms in Europe deem it advisable to remain outside this new movement.

In addition to the commercial success which has been achieved during the past year, there has been a marked technical development, the influence of which will probably be more fully felt in the course of a year or two. The size of motorships has increased up to 14,000 tons deadweight carrying capacity, while still larger craft are in contemplation and the power of individual oil engines has risen to 3,200 horsepower, not merely as a specialized type but as a standard design of which very large numbers are being built.

Three entirely new types of marine Diesel engine have



Fig. 1.—The 10,000-Ton Motorship Yngaren After Launching. She is the First of the Doxford Standard Motorships

been built in Great Britain and their trials carried out, these being the Doxford and Cammell Laird two stroke engines and the four cycle motor developed by the North British Diesel Engine Works. In addition, the first experimental Still combined steam and oil engine, designed for commercial use, has been completed and tests made, and it will therefore be gathered that builders are not relying solely upon established models but are breaking out along new lines with the object of producing engines of higher efficiency or with which some other advantage may be gained such as the possibility of constructing them in very large powers. So far have developments gone that manufacturers of four cycle engines of the Burmeister and Wain type are now prepared to build them in sizes of 4,000 horsepower, while builders of the two cycle engines of the Sulzer design are willing to manufacture 6,000-horsepower sets under any reasonable guarantee. On the Clyde, Messrs. John Brown & Company, builders of the *Lusitania* and of many transatlantic liners, are experimenting with the new Cammellaird-Fullagar engine, the object in view being its employment in powers up to 10,000 or 15,000 horsepower in large or fast transatlantic liners.

TWO STROKE VERSUS FOUR STROKE ENGINES

Although probably in four-fifths of the motorships now in service and in 75 percent of those under construction, four cycle machinery is installed; nevertheless, British engineers are by no means unanimous in their belief that the greatest progress in the future will be with this type of machinery. On the contrary, there is a very general opinion that, especially for the larger sizes, the two cycle Diesel motor will prove itself more satisfactory and will possess advantages that will render it an extremely strong competitor to the engine operating on the four cycle principle. Hence we see that the three most interesting types of motor developed during 1920, namely, the Cammellaird-Fullagar, the Doxford and the Still engines, are all two stroke machines and, moreover, while in Great Britain there are six manufacturers of marine oil engines of the four stroke type, no fewer than eleven have pinned their faith to the two stroke set.

Even the double acting two cycle engine has its advocates and the North British Diesel Engine Works, which is now building four cycle engines, is experimenting with a double acting two stroke motor with a view to its ultimate adoption in place of the existing type.

It is interesting to analyze the reasons which, it is claimed, render the two cycle engine more advantageous. The fuel consumption is admittedly higher, but only to the extent of about 7 or 8 percent, but builders who have adopted this design claim that the cost of construction is lower, the weight and space occupied are smaller and the cost of construction is naturally reduced.

NEW TYPES OF DIESEL ENGINES

There is another point in which the two stroke engine is showing its superiority. It is becoming increasingly difficult to obtain the better grades of fuel oil which have for the most part hitherto been utilized in Diesel engines. The future type of marine oil engine must therefore be designed so as to be capable of burning any grade of oil, even Mexican fuel oil. The main obstacle to its satisfactory utilization is its deleterious effect upon valves, especially on the exhaust valves. In the modern type of two cycle engine there are no valves other than those for the starting air and fuel injection. Scavenging air is admitted through ports, while a further series of ports is provided for the discharge of the exhaust gases. Provided, therefore, that combustion is good, there is no reason why almost any quality of oil should not be used satisfactorily in two stroke engines, more particularly in those of the opposed piston type in which the scavenging air sweeps right through the cylinder from bottom to top.

Of the new engines the Cammellaird-Fullagar engine has

already been described and illustrated in these pages and need not be dealt with at length. It might be recalled, however, that this engine was developed by the late Mr. H. Fullagar about 1912 and was only taken up in earnest by Cammell Laird & Company after the armistice. The first set was placed in the 500-ton coaster *Fullagar* in the early summer of 1920, and since that time the vessel has been in regular operation along the coasts of Great Britain covering about 10,000 miles, the results having proved that at any rate this particular size of the engine fulfilled all the builders' expectations.

It will be remembered that it is an opposed piston type built with unit pairs of cylinders, the crossheads of the top piston of one cylinder being joined by diagonal rods to the crossheads of the bottom adjacent cylinder. The fuel consumption has proved fairly good, being about 0.42 pound per brake horsepower hour and the results were sufficiently good to induce such well-known firms as Messrs. John Brown & Company, Messrs. Dunsmuir Jackson & Company and Messrs. David Rowan & Company, Limited, as well as a large American shipbuilding concern, to take out licenses for the construction of the Cammellaird-Fullagar type. It should, however, be borne in mind that the power of the engine on which the trials can be carried out is relatively low (being only 500 brake horsepower) and that it will be easier to give a definite opinion regarding the possibilities of the engine when larger sizes have been built. Two sets each of

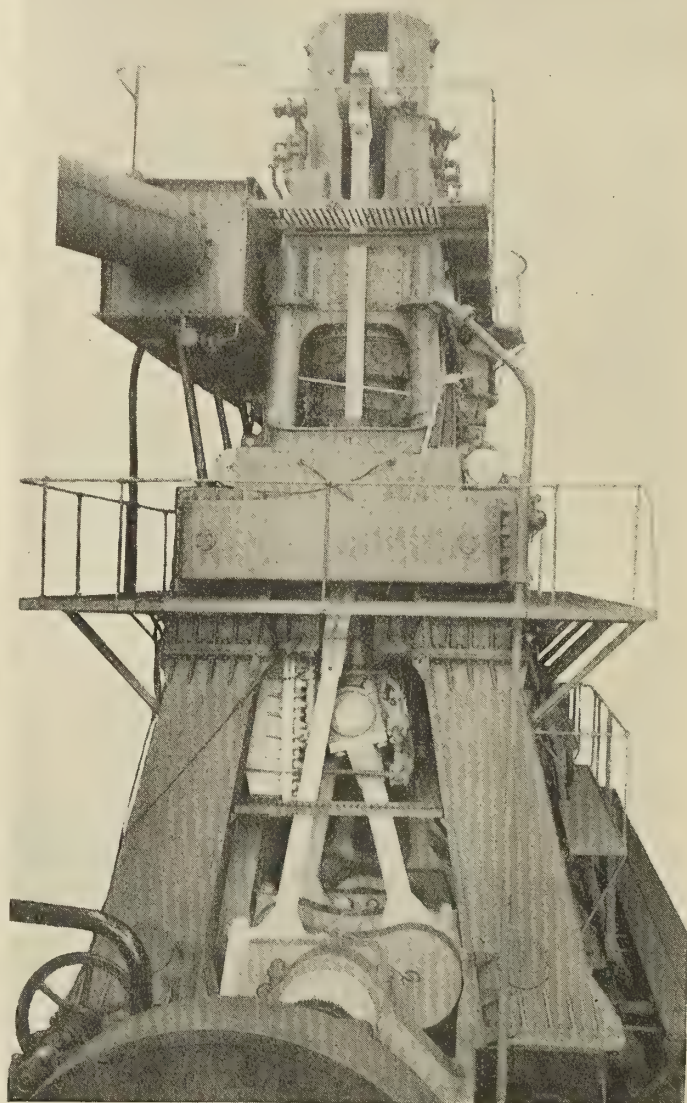


Fig. 2.—End View of 3,000-Horsepower Doxford Oil Engine

1,000 brake horsepower are now practically completed and will shortly be installed in a cargo vessel for the Ellerman Line.

COMPLETION OF THE FIRST 3,000-HORSEPOWER DOXFORD ENGINE

The development of the Doxford Diesel engine was perhaps the most interesting and important feature of oil engine construction in 1920. The builders, Messrs. W. Doxford & Sons, had so completely pinned their faith in this design that they took orders for the manufacture of six standard 3,000-horsepower sets before the first was completed and obviously it would have gone ill with them had they discovered any inherent defects when they were testing out their first motor. However, they have spent about twelve years in experimental and investigation work, so that it cannot be said they are new to the industry.

The new 3,000-horsepower standard Doxford engine, the first set of which is now undergoing its final test in the shop, is also of the opposed piston type. Having accepted this main principle, which was first applied to oil engines by Professor Junkers in Germany, the builders followed on their own ideas and produced an engine unlike any type previously constructed. In one respect it actually has a similarity to the hot bulb motor, for the two opposed pistons working in one cylinder are both provided with plates at the top made of ingot steel, which are maintained constantly at a high tem-

perature and are not cooled by the piston cooling water. The object of this is to enable a lower pressure of compression to be employed, and actually this is only 300 pounds per square inch instead of the usual 500 pounds per square inch with the normal Diesel engine. There is apparently no disadvantage in this arrangement except for the fact that the engine must be heated up by means of steam before it can be started, but this process only takes about half an hour. When the engine is running, the heat that is retained in the piston tops, combined with the heat of compression, is sufficient to provide effective combustion of the fuel, as is indicated by the fact that the Doxford engine will run at a lower minimum speed of revolution than any engine hitherto produced. The normal speed of the 3,000 indicated horsepower set is 77 revolutions per minute, and it can be throttled down to run continuously at about 16 revolutions per minute.

FUEL INJECTION AT 7,000 POUNDS PER SQUARE INCH

This characteristic of low speed operation is facilitated by the employment of solid injection, which was decided upon by the manufacturers after a long period of investigation on an experimental cylinder. Solid injection is, of course, very unusual in Diesel engines, and the only other builders who adopt the principle are Vickers, who utilize it both for mercantile and submarine engines. In the Doxford motor, however, the pressure employed is very much higher than the Vickers type, the usual figure being in the neighborhood of

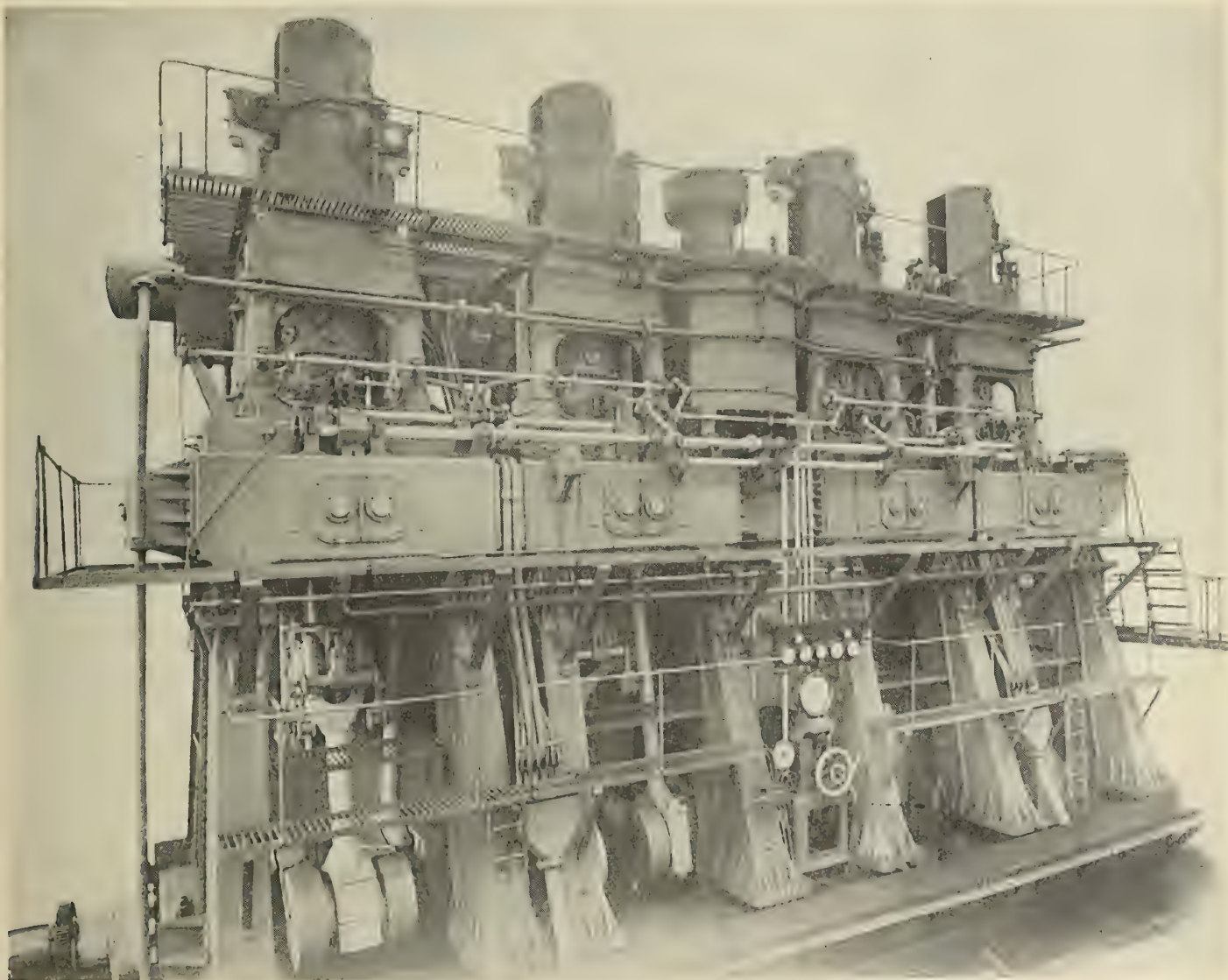


Fig. 3.—3,000-Horsepower Doxford Oil Engine

7,000 to 8,000 pounds per square inch. It is worth noting that this high pressure gives rise to no difficulties whatever, and by utilizing fuel pump without glands even leaks have apparently been entirely eliminated. In order, however, that there may be no possibility of trouble in their first engine, the manufacturers are providing two sets of pumps, one driven directly off the crankshaft of the main motor and the other by an auxiliary steam engine or electric motor, the two sets being interchangeable and both controlled by a small hand wheel at the starting platform.

The scavenging pump is located in the center of the engine, and as this is the only auxiliary driven it is natural that a high mechanical efficiency should be attained. The brake horsepower of this motor is in the neighborhood of 2,700, which is higher than that of any other marine oil engine yet built.

A very compact arrangement is effected by delivering the scavenging air into the cylinders through ports at the bottom via a scavenging trunk which surrounds the cylinder and is supported on the cast iron columns. Similarly, the exhaust gases are discharged through ports at the top of the cylinder into a belt surrounding the cylinder and then into a water cooled silencer at the back. There is a fuel valve at the back and the front of each cylinder, so as to give even admission of fuel, but it may be noted that the fuel pumps at the back are not utilized when going astern, so that only half the power is available in the astern direction. The object of this is to avoid complication of the reversing gear, so that only the camshaft at the front operating the one set of fuel valves needs to be moved when it is required to go astern.

The two camshafts are separately driven and on the one in front of the engine are two cams for each fuel valve and two for each starting valve. When it is desired to go astern all the valve levers are lifted off the cams, the camshaft is moved fore and aft, after which the air starting levers are brought into contact with their cams, admitting compressed air for a few revolutions when the fuel valve levers are brought into action and those for operating the starting valves lifted off the cams. All these operations are carried out by means of the large handwheel at the starting platform, while the movement of the camshaft is effected manually by a lever close to the maneuvering wheel. Variation of speed is obtained by reducing the lift of the fuel valves and at the same time controlling the pressure of the fuel. It is significant that fresh water is used for cooling both the cylinders and the pistons, this being unusual, although the practice of using fresh water for piston cooling is now becoming common and is adopted by Burmeister and Wain and Harland and Wolff in their large engines.

The cylinder dimensions of the Doxford engine are 580 millimeters bore and 1,160 millimeters stroke, giving a moderate piston speed of approximately 600 feet per minute. The fuel consumption appears to be in the neighborhood of 0.42 pound per brake horsepower hour and the engine is run on Mexican oil.

A NEW FOUR STROKE ENGINE

The new engine of the North British Diesel Engine Works, of Glasgow, the first example of which was only completed in December, is of an entirely different type. In the first place it is a four stroke set, the builders having decided that in the first instance there would be less risk attaching to this construction, although they intend at a later date to develop a double acting two cycle motor upon which they are now experimenting. They have standardized an eight cylinder engine of 2,330 indicated horsepower, the adoption of eight cylinders being again to diminish any possibility of trouble by employing cylinder dimensions which had previously been found suitable for four stroke work. The brake horsepower is, however, relatively high, since in the first engine the air compressors are driven by separate high speed Diesel en-

gines. The novelties in the design of this motor include what is commonly termed an entablature construction in which the entablatures supporting the cylinders are carried on steel stanchions which take the whole of the weight and the cast iron columns can therefore be made relatively light.

This design is of some interest in view of the fact that Sulzers, who were one of the originators of the idea, have abandoned it entirely and the framing of their engines consists of the usual cast iron columns. On the other hand, Harland and Wolff have adopted the steel column design, so that there is evidently no unanimity among Diesel engine builders in this direction.

The second novel feature in the North British Diesel Engine Works type of motor is the method of reversing. There is the usual pair of side-by-side cams, one for ahead and one for astern, for actuating each of the valves, but instead of lifting the valve levers, as is usual when it is desired to move the camshaft fore and aft for reversal, in this case the whole camshaft is dropped bodily away from the rollers of the valve levers while the movement is made, after which it is brought up again into contact with the cams.

THE CONVERSION OF STEAMERS TO MOTORSHIPS

One of the most significant events in the shipping world in 1920 was the commencement made of the conversion of existing steamers to motor vessels. In the opinion of many shipowners, who are finding some difficulty in operating their ships at a profit in view of the high price of coal, the conversion of tramp steamers to motor craft offers the only solution of their difficulty. Immense interest was therefore taken in the first conversion carried out on a Swedish ship owned by the Banck Line, a 5,000-ton vessel with machinery of about 1,200 horsepower. The steam engine which was displaced was an ordinary triple expansion set, and in its stead a 1,200-horsepower Sulzer two cycle motor with four cylinders was fitted. It is not known what was the cost of conversion, but it was carried out at Hamburg and the amount paid was certainly less than would have been the case had the work been done at a British yard. The saving effected, however, was sufficient to make a marked impression upon the shipowning community, for instead of using 20 tons of coal at an average price of about £7 or £8 per ton, the vessel (named the *Augusta*) now consumes only four tons of oil per day costing about £11 per ton.

There is only one obstacle which prevents a general conversion of a large portion of the existing European mercantile fleet to motor power. This lies in the high cost of work in the shipyards at the present time, particularly work of this nature, for which the men obtain higher rates than for new ships. The Transatlantic Steamship Company, of Gothenburg, had decided to commence the conversion of all their steamers to motor vessels (totalling about 25) and ordered an engine to be fitted in the first craft on which such a conversion was to be carried out. They found, however, that the expense of the work (and not of the engine) was so prohibitive that they decided to wait until there was something of a slump in shipbuilding, when they consider that prices for such work will be considerably reduced, and when that occurs they will probably transform all their steamers into motorships.

MOTOR PASSENGER LINERS

For the first time the problem of building motor passenger liners reached a practical stage in 1920. Hitherto this has been looked upon as a doubtful proposition, but early in the year the British India Steam Navigation Company, one of the largest shipping concerns in the world, decided to build three motor passenger liners for their Eastern trade. The first of these will be completed early in the near year and, although not the largest type of liner, it will afford an excellent opportunity of judging the possibilities of much bigger



Fig. 4.—New 7,000-Ton Motorship *Tosca*, Owned by Winge & Company, Christiania. The First of Four Vessels for the Same Owners. Fitted With Two 1,400-Horsepower Werkspoor Oil Engines

ships. The new ships will be mixed cargo and passenger ships carrying about 10,000 tons of cargo and 150 passengers.

More ambitious is the order placed by an Italian firm with the Ansaldo San Giorgio Company for five motor passenger liners in which machinery of 8,000 brake horsepower will be installed, while the Brostrom Line, of Stockholm, has contracted for a transatlantic motor passenger liner to be built in Scandinavia, larger than any of the vessels now contemplated. Moreover, the Elder Dempster Line, of Liverpool, has converted an existing motorship, the *Glenapp*, into a passenger vessel to trade between Liverpool and the West Coast of Africa. This ship, now named the *Aba* and fitted with Diesel machinery of 6,000 horsepower, will sail on her maiden voyage as a passenger craft early in 1921.

PROSPECTS FOR 1921

It is difficult to speak in measured terms of the prospects for 1921, which cannot fail to mark a record year in motorship development. The number of motor vessels now on order is given above, and of these it is estimated that nearly 100 will be completed during the coming year, with a total deadweight carrying capacity of between 750,000 and 800,000 tons. It must be remembered, too, that with each month the capacity of European shipyards for turning out motorships is increasing, for practically all the large shipbuilding firms in Great Britain are increasing their oil engine shops, which hitherto have been too limited in size and equipment to meet all the demands that have been made upon them. The large concerns are spending hundreds of thousands of pounds upon new equipment, and in many cases are converting what were originally boiler and steam engine shops into the most up-to-date works for the sole manufacture of oil engines. It has become fully recognized that this is the only method by which marine oil engine manufacture can be carried out to advantage, combining it with thorough standardization, so that the tendency is to build standard motor vessels equipped with machinery of standard size and construction. The results of these additions to existing workshops will be to render the manufacturers throughout Europe capable of an output two, three or even four times as great as in 1920.

The table given below shows details of a few of the motorships now in course of construction for some of the larger shipping concerns, and perhaps one of the most significant

facts in connection with the popularity of the motorship is that whereas a large number of orders for steamers have been cancelled during the past few months there does not seem to have been a single instance of a contract for a motor vessel being abandoned.

SHIPPING COMPANY	Number of Ships	Deadweight Tonnage	Indicated Horsepower
Glen Line, London.....	5	14,000	6,400
Glen Line, London.....	5	10,500	3,600
Pacific Steam Navigation Company, Liverpool.....	3	10,000	3,600
Pacific Steam Navigation Company, Liverpool.....	3	12,000	4,500
British India Steam Navigation Company, London.....	4	10,500	4,600
Tankers, Limited, Liverpool...	4	10,500	3,500
Transatlantic Company, Gothenburg.....	3	10,000	3,000
Transatlantic Company, Gothenburg.....	7	9,400	3,100
East Asiatic Company, Copenhagen.....	18	9,400 to 14,000	3,000 to 6,400
Winge & Company, Christiania, Societa Nazionale di Navigazione, Genoa.....	4	6,500	2,800
Grangesberg Ore Company, Gothenburg.....	4	12,000	8,000
Gothenburg.....	4	8,000	3,000

As an indication of the strength of the Diesel engine movement in Great Britain, the following list of firms now actively engaged in the production of motorships may be of interest:

NAME OF SHIPBUILDER	STANDARD ENGINES BUILT
1. Armstrong Whitworth & Company.....	1,700 indicated horsepower (two cycle)
2. John Brown & Company.....	
3. William Beardmore & Company.....	1,200 indicated horsepower
4. Cammell Laird & Company.....	1,000 brake horsepower
5. W. Doxford & Sons.....	3,000 indicated horsepower
6. Dunsmuir & Jackson.....	
7. Fairfield Shipbuilding and Engineering Company.....	
8. Harland & Wolff.....	1,800 and 3,200 indicated horsepower
9. Hawthorn Leslie & Company.....	1,400 indicated horsepower
10. North Eastern Marine Engineering Company.....	1,400 indicated horsepower
11. North British Diesel Engine Works.....	2,330 indicated horsepower
12. David Rowan & Company.....	
13. Swan Hunter & Wigham Richardson.....	1,500 brake horsepower
14. Alexander Stephen & Company.....	1,700 brake horsepower
15. Scott Shipbuilding and Engineering Company.....	
16. J. S. White & Company.....	2,000 brake horsepower
17. Vickers, Ltd.	1,500 brake horsepower
	1,270 brake horsepower

Of these, Messrs. Cammell Laird & Company, David Rowan & Company, John Brown & Company, and Dunsmuir and Jackson are building the Cammell Laird-Fullagar engine; Hawthorn Leslie & Company and the North Eastern Engineering Company are constructing the Werkspoor four cycle type; Armstrong Whitworth & Company and Alexander

Stephen & Company are building the Sulzer engine; Scotts Shipbuilding and Engineering Company the Still combined steam and oil engine; Harland and Wolff the Burmeister and Wain type; Beardmores the Tosi design; Swan Hunter and Wigham Richardson the Neptune Polar type; while Vickers, Doxford, Whites and the North British Diesel Engine Company are all manufacturing engines to their own design.

Among other firms which have either obtained licenses or will shortly acquire them are William Denny Brothers, of

Dumbarton; Yarrows, of Scotstoun, on the Clyde; the Wallsend Shipbuilding and Engineering Company, and Palmers Shipbuilding and Engineering Company. On the Continent the same degree of activity is being shown, and in Denmark there are three firms mainly or exclusively engaged upon motorship construction, in Sweden three, in France two, Holland two, Italy two, Norway one, and Switzerland one, in the latter case only engines being manufactured, as the Sulzer firm is not engaged in shipbuilding.

Arc Welded Ships

BY O. H. ESCHHOLZ*

Arc welding is no longer a novel process. Since the original patent of Slavianoff in 1887 it has been conservatively developed, until in many industries this form of welding has achieved merited recognition as an essential means for the fabrication of steel structures. In shipyards the metallic electrode arc is definitely established as an important tool for the repair of broken parts, replacement of worn and corroded members, securing oil- or watertight structures, and the production of non-strength joints. Some of the problems involved in the application of arc welding to shipyard work are outlined briefly in this article.

EXPERIENCE with welding in the shipyards has led to the arc welding of the Geary launch in 1915, the Newburgh barge, 1917, the Richborough barge, 1918, Norfolk towing target, 1920, and the coaster *Fullagar*, 1920. The performance of these craft under adverse conditions has clearly demonstrated the practicability of the small welded ship. The attitude of the welding research sub-committee of the welding committee of the United States Shipping Board in 1918 was that "there are no outstanding technical questions requiring solution in order to proceed at once to the construction of welded ships."

ADVANTAGES OF ARC WELDING

The advantages derived by arc welding usually cited are:

(1) With the elimination of marking off, drilling or punching, countersinking and calking, a considerable economy in time and labor can be effected.

(2) By the reduction in width of laps and size of butt straps a saving of from 5 to 10 percent of material can be effected.

(3) Welded joints can be made to withstand greater stresses than similar riveted joints, and can be made equal in strength to the ship plating.

(4) Once the practice is standard a reduction in the weight of the shell plating will be possible without reducing the safety factor.

(5) A welded joint is oil- and watertight up to its breaking point, whereas riveted and calked joints are liable to leak badly at as low as 25 percent of their ultimate strength.

It is generally recognized that arc welding has come to stay in the shipyard. As an indication of the faith of the English builders in the future of the welded ship, the following list of projected vessels is of interest. In Lloyds Annual Report for the last year reference is made to a design which had been submitted and approved for the welded construction

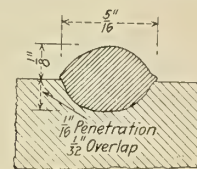
of a longitudinally framed vessel 303 feet long. Designs have been prepared by one of Vicker's associated companies for the welded construction of a large number of self-propelled barges, 125 feet long, 16 feet beam, 320 tons displacement, in France. The Forth Ship Building Company at Alloa has prepared designs for the construction of a welded tanker. At Millford Haven arc welding is being used extensively to convert an ordinary cargo vessel into an oil tank boat. The coaster *Fullagar*, recently launched by Cammell



Fig. 1.—Appearance of Metallic Electrode Welding Arc. The Molten End of the Wire Electrode is Shown Assuming a Globular Shape Preliminary to Being Released and Deposited on Plate



Fig. 2.—Etched Section Through a Single Layer of Metal Deposited (Welded) on Plate. Note the Zone of Fusion, Crystal Structure Change, Penetration and Overlap



Laird & Company, is an experiment with the view of employing similar welded construction in larger vessels.

WELDING ACTIVITIES PROPOSED

An established process, such as riveting, obviously yields ground slowly to one less known. This inertia can be overcome by the liberal dissemination of knowledge concerning the newer process and experience with its application. In this connection it is important to note that at a recent meeting of the American Bureau of Welding some of the major activities proposed for the ensuing year were:

(1) Development of a standard training course for the education of supervisors and arc manipulators.

(2) Standardization of weld inspection and test methods.

(3) Standardization of welding procedure for various applications.

(4) Compilation of available data concerning physical properties and cost of welded members.

The problem of the all welded ship is essentially that of educating the design and construction staff in the characteristics and use of the process. Its employment on a large scale for the joining of strength members requires the building up of a welding organization comprising superintendents,

* Material and process engineering department, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.; member of American Bureau of Welding.

foremen and operators who are expert and conscientious in the use of the process before cautious engineers are justified in specifying the extensive substitution of welding for riveting.

FEEDING MATERIALS AND ASSEMBLING METHODS

A problem second in importance only to that of training* is the development of materials feeding procedure and assembling methods that will assure a minimum interruption to the operator and negligible residual strains in the welded area caused by the contraction of the deposited metal. Most of the larger welded structures such as frames and platings



Fig. 3.—Etched Section, Showing Fusion Pattern on Building Up a Heavy Deposit by Layer Deposition. (In Order to Facilitate a Definite Marking of the Fusion Boundaries Two Types of Electrodes Were Used)

in the experimental vessels were assembled to form lap or butt strap joints by means of service bolts and tack welds. As this method detracts somewhat from the advantages to be derived in welding, various expedients are being developed that will accomplish the same purpose without the necessity of

* Training of Arc Welder, O. H. Eschholz, *Electrical World*, September 27, October 4, 1919. Overhead Arc Welding, O. H. Eschholz, *Power*, November 16, 1920.

perforating the plates. In this connection it is desirable to point out that the welding conference committee of the American Welding Society is compiling the experience of numerous manufacturers in the construction of welded pressure vessels and a second committee is engaged in the design of a large welded storage tank. The experience that will be available in the coming year from the welding of such plate structures will be applicable in numerous ways to ship-building.

It is frequently stated that the characteristics of a weld are dependent to a large degree upon the "personal equation" of the welder. An analysis of the arc welding process shows that it is peculiarly susceptible to control, a characteristic that it possesses in common with electrical apparatus and electrical processes. The development of a control to minimize the human variability factors and by fixing the arc current, arc length, direction of deposition, and materials used is merely a matter of an adequate welding organization.

VISUAL EXAMINATION OF DEPOSITED METAL

With the increased dispersion of a technical knowledge of

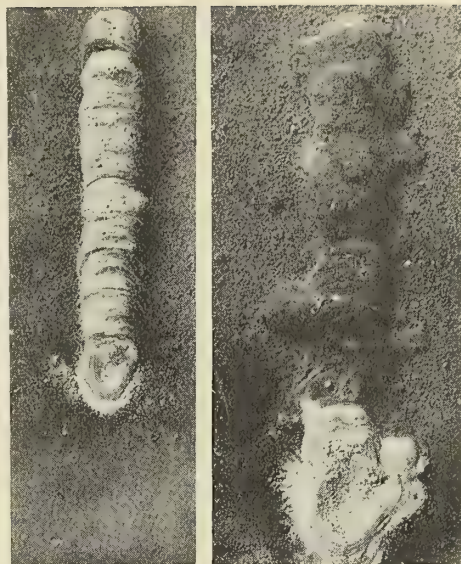


Fig. 4.—Surface View of Layers Deposited When Holding a Short Arc, Left, and a Long Arc, Right. Note Difference in Contour, Density and Distribution of Oxide

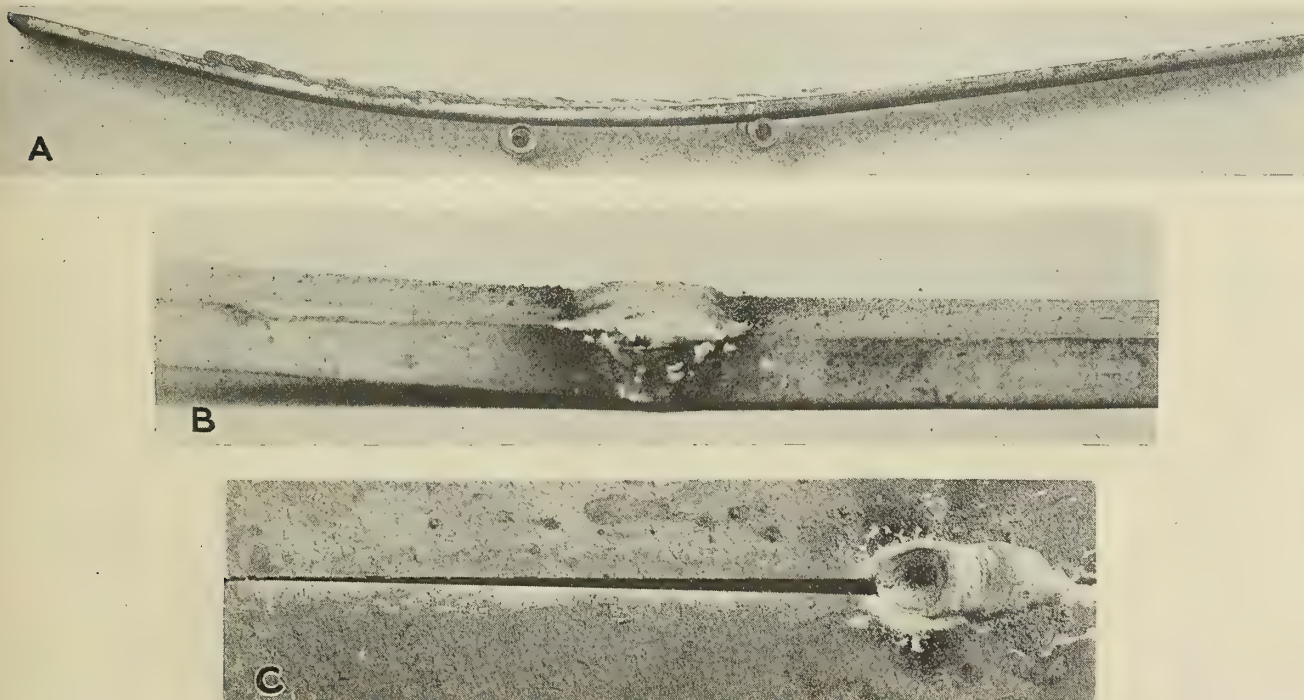


Fig. 5.—Plate Movement Caused by Contraction of Hot Deposited Metal Upon Cooling. A, Longitudinal Contraction in Layer. B, Transverse Contraction in Metal. C, Example of Stresses Produced by Contraction Drawing Plates Together Initially Separated $\frac{1}{8}$ Inch

the process the significance of visual* examination of deposited metal will be obvious. The salient characteristics of fusion—overlap, penetration, oxide distribution, crater depth—are clearly revealed to the trained eye and give a quite satisfactory indication of the workmanship and characteristics of the weld. Electrical and magnetic inspection methods are now in an advanced stage of development; these, when available, will give a further check on the degree of fusion and soundness of the deposited metal. It is necessary to point out, however, that none of these methods gives a measure of the value or distribution of residual stresses. As such stresses are determined by the method of assembly and design of joint, their evaluation falls within the province of an engineer or designer.

COST OF WELDING

The cost of application is the final criterion of the process. Two important factors that are susceptible of considerable reduction are cost of electrodes and welder's time. The practice of the British ship welders has been to employ special covered electrodes. The manufacturers of these electrodes have been largely responsible for the impetus given to ship welding in England, a number of them having secured Lloyd's approval for the application of arc welding to a large number of parts, as well as for the design and supervision of the welded Richborough barge and the 425-ton coaster *Fullagar*. The cost of such electrodes, however, places quite a burden on welding. With the present increased scientific knowledge of the characteristics of the cheaper bare electrodes, it should be possible to obtain for them nearly as broad a classification.

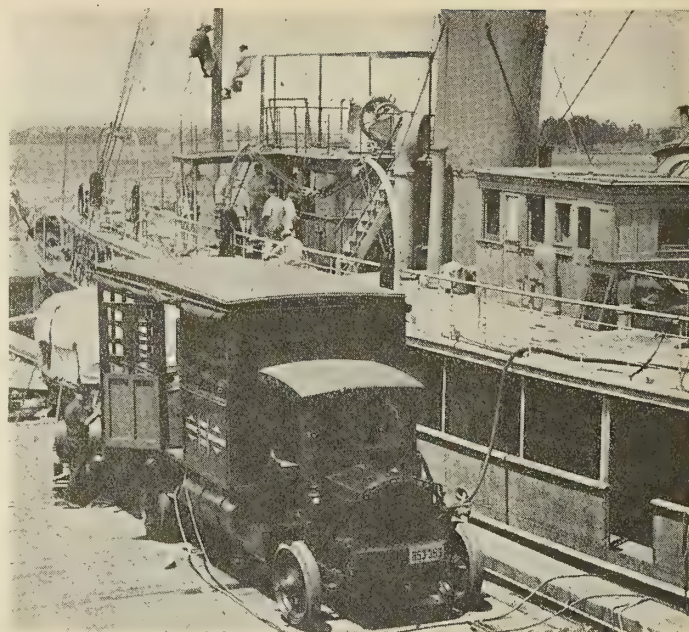
With the use of a given electrode, current density and a short arc length, the speed of metal deposition is a direct function of the arc welding current. This fact should be clearly recognized by designers in order that wherever feasible the joint will be given a high thermal capacity, thereby permitting the use of a high welding current and a resulting high welding speed. There is already a tendency to take advantage of this characteristic of arc welded joints. A few years ago a value of 125 amperes was considered to be the proper welding current for most work; now many applications employ 175 amperes and the future points to the use, with suitably designed joints, of 225 and 250 amperes.

While the all-welded ship is the ultimate goal of welding enthusiasts, it is recognized that its logical development will come only through the cautious displacement of riveting by an organization fully conscious of the merits of the two processes. The welding of non-strength members, not adaptable to inexpensive riveting in the fabricating shops, will occupy the first stage, the welding of superstructures, internal division fittings, deck plates, oil tanks the second stage, and with the availability of adequate process control and inspection methods the process will be extended to the welding of the main strength members composing the frames and shell.

Electric Welding Plant Mounted on Motor Truck

MOUNTED on the chassis of a Packard motor truck owned by the United Marine Contracting Company, of New York City, is a complete self-contained, portable electric arc welding outfit for either land or marine work. It is the first and only motor truck arc welding plant in the country and serves as a striking example of the adaptability of the motor truck to an ever-increasing cycle of industrial uses.

Stimulated during the war by the necessity of keeping every available ship in running order, the electric arc welding process for marine transportation purposes was greatly improved. Barges equipped with complete welding plants to facilitate the repair of cracked boilers and broken engine



Portable Welding Plant in Operation

parts that could not be brought to a stationary shop resulted from the energetic efforts to keep warships in commission.

The Covic Electric Company, of New York, undertook to meet this need for a portable land outfit by mounting an electric welding apparatus on a motor truck. The object was to serve as economically as possible both the marine and land requirements. Due to its greater mobility, such a machine could travel from job to job much more quickly, cutting down the idle time of the welding plant and crew. The truck also eliminates a towing bill, which is always necessary in the case of the barge, resulting in a considerable saving on each job.

The unit finally developed consists of a Packard heavy duty chassis on which is mounted a large body of special design which gives ample space for the apparatus and for supplies. Directly over the rear axle is the power plant, including an electric generator driven by a 40-horsepower gas-kerosene engine, which produces a direct current of 150 amperes for each welder at 50 volts. The capacity of a machine is two welders.

Welding supplies such as short lengths of welding wire, welding glasses, hammers, etc., are carried in small compartments built on the under side at the rear of the body. A 40-gallon spare fuel tank is provided, as is also a tank for 20 gallons of lubricating oil for all machinery.

In the forward part of the body is mounted a 90-foot air compressor to supply compressed air for the pneumatic hammers and tools which are used in preparing the pieces to be welded and in finishing off the completed weld. This compressor is driven by the Packard motor through a power take-off from the drive shaft. Twenty horsepower is required to operate this machine at 250 revolutions per minute.

A special transmission was designed for this truck to provide for operating the air compressor from the drive shaft. A Morse chain is used to transmit the power from a sprocket on the drive shaft to a sprocket on the compressor. These sprockets provide for a reduction ratio of four to one in order to give the desired 250 revolutions per minute.

The truck is provided with a work bench which has the necessary equipment needed for an emergency. The body is fitted up with electric light, current for which is supplied by the generator. This makes night operation possible and quite safe.

The crew consists of six men—two welders, two chippers, an engineer and his helper.

* Fusion in Arc Welding, O. H. Eschholz, American Institute of Electrical Engineers, March, 1919.

Progress of Welding in the Shipyards

BY WILLIAM T. BONNER*

The year now closing has witnessed a wonderful development in the ship welding art. We no longer speak of the welder's metallic electrode as the spirit wand with which he performs his magic transformations behind the dazzling arc. Wonderful as they are, we may now behold these operations as they are progressively projected on the screen and study the phenomena of fusing plate to plate as we formerly studied a moving picture of riveting.

CHEMISTRY, metallurgy and photography have combined to show us what constitutes a good weld. How to make them is now an open secret. We have long known, of course, that electrically deposited metal is, primarily, a casting and its characteristics correspond closely to those of any other casting made of similar materials in so far as its tensile strength, ductility and other physical qualities are concerned. To a certain extent, however, it is better than castings made in the ordinary way, since it is free from the contaminating influences of the foundry mold and also the oxidizing effect of the coke fires, and it is expected we shall ultimately learn how to treat our electric welds when made so as to convert them from castings into forgings.

Our 1920 progress in welding has confirmed our previous conclusions about welding in many particulars. Leading engineers are now generally agreed that the short arc of, say, $\frac{1}{8}$ inch, with current of 16 to 20 volts across the arc, is preferable to any other. It permits making a thoroughly good weld, absolutely free of porous spots, and it avoids the oxidizing opportunities always present when the molten metal is traversing the path of a long arc.

ADVANTAGES OF USING HIGHER AMPERAGE

Both manufacturers and users of welding equipment have also learned the advantage of using higher amperage, especially for work in exposed situations and where the material volume is sufficient to withstand the greater heat impact; 170 to 180 amperes for welding $\frac{1}{2}$ -inch plate does not appeal to the operator who wants a job to last, but it ensures a good weld and a quick one when rightly handled and backed up by a machine with ample copper content to absorb all of the shocks due to electrode imperfections and inequalities in the work.

No welding generator should be designed for less than 175 amperes normal rating for shipyard service, unless it be intended exclusively for the shop fabrication of light tank and ventilator work. In fact, the present year has witnessed a decided move in the direction of 250- and 300-ampere plate welding with $\frac{3}{16}$ -inch and $\frac{1}{4}$ -inch electrodes, although the field for that must be limited to heavy plates and steel castings with extended seam areas.

Were we content to limit our welds to the quality of a good casting, regardless of the efficiency of the fused junction of weld and virgin metal, we might select any combination of wire and amperes which would give us a fusing temperature of approximately 3,200 degrees F., that being the temperature at which steel founders generally expect to obtain the best results. When poured at temperatures higher than 3,200 degrees F., steel castings become brittle and they also show pronounced indications of oxidation. As near as it can be determined, the physical heat of the arc is in the neighborhood of 6,400 degrees to 6,600 degrees F., and were it not for certain modifying conditions our welds would all suffer from the application of that excessive temperature.

One of these conditions is the disproportion of the arc contact to the work area and the heat tempering influence

which the latter exerts. Another, and that most important, is the fact that with the short arc the flow of metal between the electrode tip and the work is so rapid that it almost amounts to a continuous stream of sufficient density to establish a current bridge. In fact, the oscillograph has shown us that the current actually does short circuit the welder's arc an average of 25 times each second, and, while these shorts break the arc only momentarily, they afford sufficient relief to maintain an average temperature on the work which does not exceed safe metallurgic limits.

Following through the logic of this phenomenon it may be safely reasoned that with a current of low voltage, and low amperage also, there would not be sufficient energy to re-establish the arc after each of these short circuits unless the operator is content repeatedly to "commence again." The inevitable result of that method is uneven, porous welds, scaly surfaces and lack of fusion between weld and parent metal. A higher amperage, however, will tend to fuse off the elongated "necks" which form at the end of the electrode with each short circuit and insure a quick return of the arc.

ELECTRICALLY WELDED SEAMS FOR PLATING

It is no longer necessary to hesitate about using electrically welded seams for plating because of any real lack of efficiency in that method. The brightest engineers of this generation are actively competing with each other in their efforts to gain first honors in welding research, and many problems of theory, which only yesterday were considered unsolvable by some, have now become the routine of every-day practice.

This may be accounted for in several ways, all of them, no doubt, contributing their share toward the more general success which has attended the extension of welding operations during 1920. Foremost in the list of causes may be found the growing spirit of "justice to all systems," which the welding engineer makes a first order of business the moment he begins an engagement. Trying to arc weld a gas job, and vice versa, simply because the "boss" happened to know more about one than the other, or because he had no equipment for doing it that way, has done much to prejudice owners and constructors against welding. Fortunately, the growth of the demand for welding has created a new and very useful official, the welding engineer, whose duties are to consider each undertaking on its own particular merits and to recommend how and by what method or system it shall be welded. For one job he may prescribe gas, for another thermit, and another arc or spot welding. He may, if he be a real engineer, turn down all of the autogenous methods and call in the riveters. There are many situations where the latter system is not only cheaper, but better.

Knowing what not to use is always an indication of real ability.

It is believed 1920 has witnessed the flood and we shall now have a decided ebb in the tide which has torn labor from its safe moorings on the question of service and that war-time demands will gradually give way to real effort to earn the pay envelope contents. The progress of welding has been noticeably impeded by the contention that however efficient a weld *might* be made, its real value lies in the

* Engineer welded ship construction; member, Society Naval Architects and Marine Engineers, American Welding Society.

quality of its workmanship, and welders, more than any other mechanics, have wholly failed to prove their loyalty by doing universally good work. Unfortunately, that contention is absolutely true, but, thanks to the perseverance of the devotees of this new art, a new spirit of interest beyond that of selfish monetary gain is being developed by the mechanics and we now find them constantly seeking advice as to how they may avoid the failures with which they have heretofore been charged.

Knowing how and the will to do it constitutes real team work, in the face of which failure is 99 percent eliminated.

EDUCATION OF WELDERS

The very extended discussion which was given to Professor Chapman's paper on "University Education in Ship Construction" at the last annual meeting of the Society of Naval Architects plainly indicates a widespread interest in the betterment of the shipworker's mentality.

Nearly all large manufacturing concerns now provide for the education of their employees in such special lines as will enlarge their field of usefulness and the recognition which is being given to welding in this educational movement augurs well for its future establishment as a means of constructing ships.

Drexel Institute, in Philadelphia, may be cited as a good example of what can be accomplished in this line. They do not attack the problem from the trade school standpoint, but aim for the higher education of the welder by giving him the mathematics and the metallurgy of the art and so fit him to become a leader and a teacher. The practical part is treated by demonstration only; the actual experience must be obtained in the shipyard.

THE AMERICAN WELDING SOCIETY

The importance of the welding art is reflected in no small measure by the activities of the American Welding Society, one of the newest but not the least vigorous of the American technical societies. Organized in 1919 as a logical outgrowth of the Emergency Fleet Welding Committee, a body of eminent engineers appointed to aid in winning the war, the society has grown until it now has upwards of 1,000 members with local sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and other large centers.

Close affiliation is maintained by the society with the various Government bureaus, War and Navy Departments, National Research Council, Congressional and other libraries, chemical and metallurgical laboratories and other technical research organizations, to insure co-operation in any investigation undertaken by the society for the benefit of its members.

This is a society for promoting the science and art of welding and its accessory operations.

ATTITUDE OF THE CLASSIFICATION SOCIETIES

While the classification societies have made no material change in their schedules of permissible welding, as, for instance, Lloyd's list of non-structural parts contained in the society's circular No. 1,328, approved by the committee October 6, 1919; greater latitude is continually being given to the local inspectors as to their interpretation of what shall and what shall not be welded in the construction of a ship. All such special rulings, however, have conformed to the general provision of Lloyd's circular No. 1,328, and the net effect has been to enlarge the volume of welding without encroaching upon the society's limitation of its use on non-structural parts.

Because of the builders' present state of unpreparedness, both as to equipment and personnel, this has not been considered a hardship. Our 1921 review will, no doubt, tell a different story, as the classification societies, both here and abroad, have all been keenly observing the progress of welding and will undoubtedly show their progressiveness by ap-

proving its use for strength members as soon as the builders are properly equipped for undertaking that form of construction.

In a leaflet recently issued by a prominent indexing firm, a list of permissible welding, which had been prepared from the paper on that subject published in *MARINE ENGINEERING* of April, 1920, was made to indicate that Lloyds might class all vessels whereon welding had been employed as "experimental" even though the amount of such welding might be very small.

Actually, there would be no such limitation to a vessel's classification, as above intimated, as where welding is confined to the circular No. 1,328 list of non-structural parts, the classification would remain 100 A-1 or 100 A-1, "awning" or "shelter deck with freeboard," without any notation in regard to the use of electric welding.

To put it still more clearly, in cases where it is proposed to adopt electric welding generally in the construction of vessels, Lloyd's Register requires the system of welding to be approved and the details of construction of the vessel and of the welds to be submitted for approval.

Provisional rules have been adopted by Lloyds as a tentative measure for the classification of vessels electrically welded, as provided in section 74 of Lloyd's rules for 1919-20, and the classification of such ships in the Register book bears the notation: "experimental" and "electrically welded."

The interest of the American Bureau of Shipping in the progress of welding is none the less keen and American Bureau of Shipping inspectors are everywhere on the alert to note its progress. Owing to the great similarity of rulings on that form of construction, i. e., as between the American Bureau and Lloyds, separate reference is hardly required, as any recital of the activities of one would be close akin to the other.

WELDING APPROVED BY STEAMBOAT INSPECTION SERVICE

It is not generally realized to what extent welding is approved by the board of supervising inspectors of the United States Steamboat Inspection Service, yet it is now a matter of current practice, under their direction, to weld cracks in front heads of main boilers, weld collars around fore and aft stays, weld all stays of furnaces and combustion chambers, reinforce all seams and rivet heads of furnaces and combustion chambers, weld tubes to flue sheet, weld all hard patches on all parts of boilers, weld cracks in shell of boiler, also furnace cracks, weld girth seams of boiler, build up boiler plates where pitted and corroded, build up worn and corroded tail shafts, repair hull plating rivet seams, fill out loose rivets, repair plate edge cracks, and many other repairs to boilers, fittings and the ship's structure, even where same may be subject to the Inspection Service regulations.

It should be borne in mind, however, that no welding operations may be undertaken under the auspices of the Steamboat Inspection Service until coupons showing the character of the work proposed shall have been made and tested, and the local inspectors are satisfied by personal investigation, whether the welding process can be safely used. Evidently the welding method is proving satisfactory in view of the many important repairs which are being constantly made on the pressure parts of the main boilers of numberless ships.

That being the case, why should the strength parts of a ship's hull be denied treatment by the welder's magic wand? Surely no greater risk to the ship's passengers would be invited by welding her frames than by repairing a 24-inch furnace crack in one of the main boilers.

ATTITUDE OF SHIPBUILDERS TOWARD WELDING

On the whole the attitude of shipbuilders generally may be said to be favorable. This view is a composite of the opinions of more than forty of our leading constructors, recently ob-

tained, and the fact that they actually are showing their faith in welding by investing heavily in equipment for its use proves conclusively that they recognize its value as a shipyard accessory.

NORTH EAST COAST YARDS

In the New England district there is perhaps less preparation for welding than in other sections of the United States, but this may be accounted for largely by the fact that the majority of the yards are devoted to the construction of wood or composite ships.

NEW YORK BAY OR METROPOLITAN DISTRICT

In what may be called the New York Bay or Metropolitan district the interest in welding is very keen. The constructors of that section appear to welcome opportunity for publicity in connection with their welding operations and announce their intention to extend its use as far as possible. Their reason for this is, no doubt, perfectly logical, inasmuch as the New York district yards are largely devoted to repair work for which arc and gas welding may be considered essentially a pre-requisite to success.

DELAWARE RIVER DISTRICT

The Delaware River district is now looked upon as the leading shipbuilding section of this country, the Delaware being called by many the Clyde of America. However true that appellation may be, it certainly is a great center for the welding industry, for in no other section have the constructors reported such relatively large numbers of machines and men. As other students may have learned, however, this is not the most fruitful of our country's districts in which to secure inside information concerning the shipbuilding industry, and much that might be told of the progress of welding in the Delaware river district must remain as a sealed book. Happily, there are exceptions to this, as in all cases.

Practically all of the modern methods are utilized, likewise some that are not so modern. One of the large Philadelphia yards, for instance, still adheres to the comparatively old carbon arc or graphite system of welding and appears to prefer it to all others. No doubt they have the good fortune also to retain some of the old-time operators who are peculiarly expert in manipulating the carbon electrode—men who have an inborn grip on the true metallurgy of their phase of the art just as the same firm still retains some of their old forge workers than whom no more expert welders of the hammer and tongs exist today.

In other yards, both large and small, the gas and metallic arc methods may be found, sometimes one in the lead and sometimes the other, with no apparent reason why, unless it be the universal woman's reason, "because," or, what is equally convenient, "it just happens that way." Such reasons, however, are not likely to remain long unchallenged by those responsible for results. Anything obtainable was necessarily acceptable during the war period, but with the return of competition between shipbuilders it is altogether probable the fittest of the different systems will, in due course, appear as the sole survivor.

MIDDLE ATLANTIC AND POTOMAC RIVER DISTRICT

Some of our best shipyards are located in the Middle Atlantic section, and while all use welding to a greater or less extent, the number of men and machines employed differs greatly in the different yards. Some do not have any equipment whatever, but contract with outside parties to supply welding service as required. At Newport News a total of 156 gas and electric welders and chippers and 57 leaders, apprentices, chippers and helpers are employed in a single yard, and here it is that reports of progress are most gratifying. With them welding has become a fixed institution, and while the management do not feel prepared as yet to go on record relative to the further extension of welding, owing to

its status as a comparatively new art, nevertheless "the street" is well satisfied the amount of welding now being regularly undertaken as a matter of routine at Newport News is proof positive that the above organization is not wholly engaged on corrective work.

The Navy Yard at Norfolk is generally regarded as the pacemaker in matters of research and development of welding for battleships and other governmental vessels. In carrying out this policy the different bureaus interested have supplied Norfolk with extensive equipment, they have organized training schools and they have expended large sums in demonstration work.

GULF COAST YARDS

Like shipbuilding generally, the progress of welding in the Gulf Coast yards is relatively uncertain. Many of the yards which sprang into existence during the war period have just as suddenly disappeared and the more permanent concerns are marking time until their future policy can be more definitely determined. Practically all of these yards have been using welding and will continue its use later, some, in fact, appearing to feel very favorable toward its further extension.

GREAT LAKES DISTRICT

It may require the yards in the Great Lakes district some time to settle down from the excitement of their recent experiences in salt water shipbuilding. No more progressive constructors are to be found, however, and the response of the naval architect of one of the largest of the Great Lakes organizations may be considered indicative of the attitude of all when he states that up to the present time they have not made sufficient use of electric welders to develop any standard practice with respect to their use on certain parts of the ships, but they do expect in the future to extend their use of these appliances.

PACIFIC COAST YARDS

The use of electric welding for ship repairs had some of its early beginnings on the Pacific Coast, but for new construction it was not generally adopted until recently. Now, as may be seen by reference to the Bethlehem Corporation's table, elsewhere referred to in this paper, the Union plants are making extended use of welding, and the same may be said of the yards in Seattle, Oakland, Long Beach, Los Angeles and other centers. At the Mare Island Navy Yard they are doing more welding than many of our Atlantic Coast yards; in fact, it is reported that the completion of an all-welded vessel to be used in connection with the salvage of airplanes only awaits the allowance of final appropriation.

Everywhere throughout the entire country there is a very general interest in the progress of welding, and one need not be unduly optimistic to believe the day is not far distant when that interest will have become an actuality—an every-day routine of ship construction.

TYPICAL EXAMPLES OF WELDING

In order to add interest and value to our review of shipyard welding operations it is believed a few illustrations of typical jobs carried out at our American yards at different times will assist constructors to a better understanding of the value of welding.

Engineers have been able for a long time past to produce efficient welds, and while it is admitted the difficulties in the way of obtaining universally good jointures are serious principally on account of the personal equation, nevertheless very excellent examples of successful undertakings are continually being produced. A few of these may be mentioned.

WELDING CROW'S NEST

Electrically welding crow's nests to ships' masts is one of the very novel though useful applications of that method of

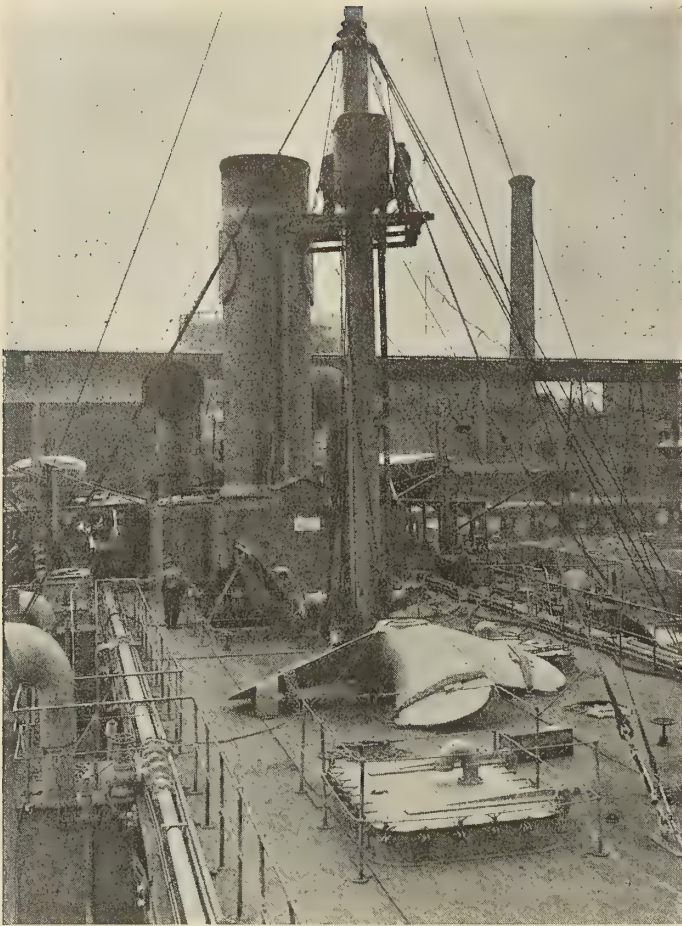


Fig. 1.—Crow's Nest of *Hisco* Welded to Mast by Electric Arc Process

construction. Fig. 1 shows a deck view of the steamship *Hisco* nearing completion at the Chester shipyard in 1917. The crow's nest structure required an unusual amount of "drawing up" to obtain a proper fit around the mast, but this was readily accomplished without providing a single assembly bolt and the weld was completed in much less time and at less cost than would have been required for former methods of making the connection.

VENTILATOR PIPE AND FITTINGS

With properly regulated generators, light plate work such as engine room oil tanks, crank case drip pans, ventilator pipe, and fittings, similar to the group illustrated in Fig. 2, may be arc welded at much less expense for material and

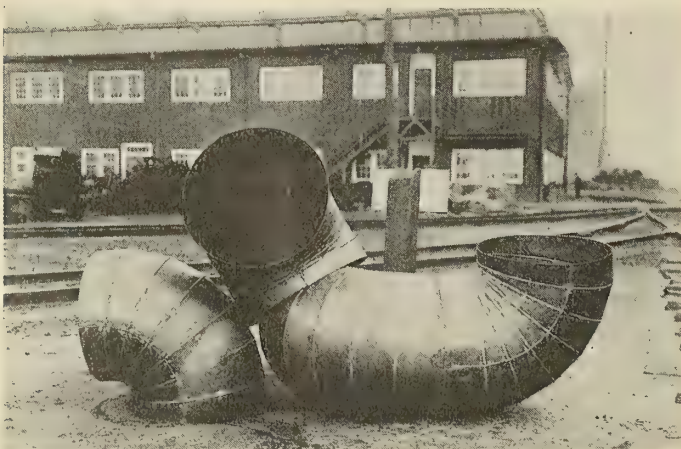


Fig. 2.—Arc Welded Ventilator Pipes



Fig. 3.—Sanitary Bulkhead Panel Spot Welded to Lugs Which Are Arc Welded to Frame

labor than is required for riveting, and when joints are rough ground their outward appearance is vastly improved.

SANITARY BULKHEAD PANELS

For comparison with the above, Fig. 3 illustrates a simple form of sanitary bulkhead panel. The panel plate is of No. 20 gage steel, spot welded to $\frac{1}{8}$ -inch lugs distributed along each edge and arc welded to the frame, as may be clearly seen in Fig. 3. The frame is made of standard steel pipe, arc welded at the four mitred corners.

The finished panel was tested by supporting the weight of seven men standing clear of the frame, their combined weight being entirely supported by the two $\frac{1}{4}$ -inch spot welds which secured the panel plate to each of the eleven small lugs. The panel meantime was lying upside down in order to throw the greatest possible strain on the spot welds. The test did not develop the slightest indication of stress on any of the spots.

ENGINE ROOM SKYLIGHTS

Photographs of an excellent example of engine room skylight construction (Figs. 4 and 5) have been contributed by Mr. E. H. Ewertz, general manager of the Bethlehem Ship-

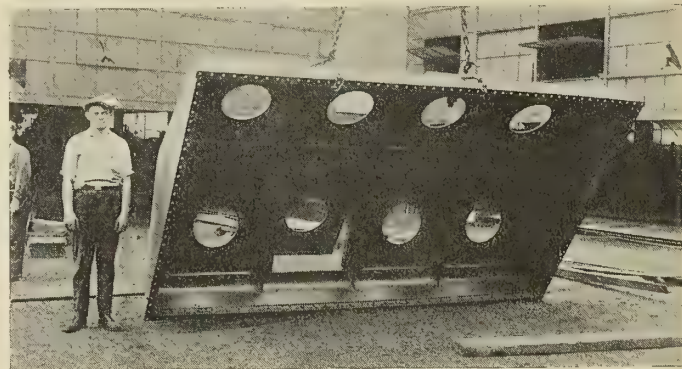


Fig. 4.—Interior of Engine Room Skylight

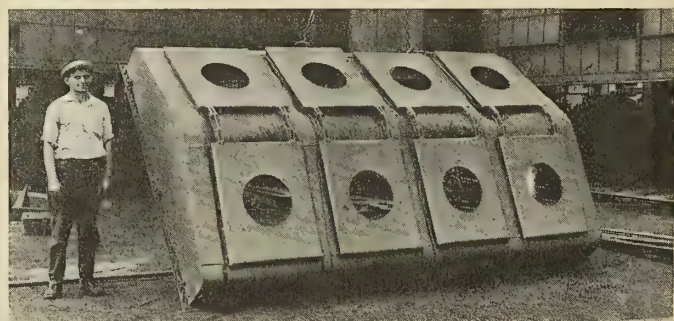


Fig. 5.—Exterior of Engine Room Skylight

RECORD OF WELDING WORK (ELECTRIC ARC) BETHLEHEM SHIPBUILDING CORPORATION LTD.

PART OR ITEM WELDED	APPROVED BY CLASSIFICATION SOCIETY	FORE RIVER		SPARROWS PT.		HARLAN		MOORE		{ POTRERO RISDON		ALAMEDA	
		OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS
Manhole Reinforcing and Protecting Angles	■	■		■	All	■		■		■		■	
Masts	□	■		■		■		■		■		■	
Mast Fittings	□	■	Butts of Rings	■	Butts of Rings	■		■	Butts of Steps & Rings	■	Small Pad Eyes welded to Decks Boom Seats to Deck	■	BUTTS OF RINGS, SMALL PADS ETC WELDED TO MASTS AND DECKS
Attaching Flanges to Pipe	□	■		■		■		■		■		■	
Attaching Fittings to Pipe	□	■		■		■		■		■		■	
Conduit & Pipe Supports attached in Place	□	■		■		■		■		■		■	
Filter Boxes	□	■		■		■		■	Corners welded	■		■	
Stanchion Collars attached to Stanchions (Hold)	□	■		■	H. Section used	■	Butts of Collars	■	Butts of Collars	■		■	
Stanchions attached to Tan Top & Decks (Hold)	□	■		■		■		■		■	Between Deck Stanchions welded to Deck	■	Floor Stanchions under Engine Foundation
Boiler & Engine Foundations	□	■	Top Foundation Plating Joints Destroyers	■		■		■		■		■	
Fresh Water Tanks	■	■		■		■		■	Intend to weld in future	■		■	
Lubricating Oil Tanks	■	■		■		■		■		■		■	
Other Tanks	■	■	Oil Tanks	■		■		■		■		■	
Shaft Alley Escapes	■	■		■		■		■		■		■	Pump Room Escape Trunks
Deck Houses	■	■		■	Butts & Corners of Angle Framing	■		■	Butts & Corners of Angle Framing	■	Butts of Reaming Watertight Collars	■	Companion Ways completely welded
Grab Rods on Exterior & Interior of Deck Houses	■	■		■		■		■		■		■	
Attaching Galley Fixtures to Casing	■	■	Destroyers	■	Bolted	■		■		■		■	
Attaching Bath & other Fixtures in Officers' Quarters	■	■	Destroyers	■		■		■		■		■	
Stacks & Uptakes	■	■	Corners of Uptakes	■		■		■		■	GALLERY STACK RINGS TO DECK & STACK SUPPORTS SHROUD PIES TO DECKS	■	
Smoke Stack Deck Collars & Angle Rings	■	■	Butts	■	Butts	■		■		■	Butts of Rings	■	Butts of Rings
Attaching Stack Deck Collars to Decks	□	■		■		■		■		■		■	
Smoke Stack Cape Rings	■	■	Butts	■	Butts	■		■		■	Butts of Rings	■	Butts of Rings
Attaching Cape Rings to Smoke Stacks	■	■		■		■		■		■		■	
Boiler Casings	□	■	Corners	■	Ends of Butt Straps of Scotch Boilers	■	Ends of Butt Straps of Scotch Boilers	■		■		■	
Coal Chutes	■	■		■		■		■		■		■	Corners of Chutes
Cargo Batton Cleats in Place	■	■		■		■		■		■		■	
Attaching Deck Rail Stanchions to Platings	■	■	Occasionally	■		■		■		■		■	
Attaching Deck Rail Stanchion Sockets to Platings	■	■	Occasionally	■		■		■		■		■	
Awning Stanchion Clips or Brackets to Stanchions	■	■	Occasionally	■		■		■		■		■	
Joints of continuous Railing Rods	■	■		■	Pipe Joints made	■		■		■		■	
Bulwark Rail Tops	■	■		■		■		■		■		■	
Engine & Pump Foundation Pans	□	■		■	Plate Flanged & Corners welded	■		■		■		■	
Condensers	□	■	Butts of Frames Corners of Casings Aux. Con. Complete	■		■	Corners of Casings & Butts of Framing	■	Flanges & Fittings welded on Surface Cond.	■	Rings only	■	Rings only

Fig. 6

RECORD OF WELDING WORK BETHLEHEM SHIPBUILDING CORPORATION LTD.													
PART OR ITEM WELDED	APPROVED BY CLASSIFICATION SOCIETY	FORE RIVER		SPARROWS PT		HARLAN		MOORE		POTRERO		ALAMEDA	
		OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS
Hatch Coamings	☐	☒		☒	Corners	☒	Corners Occasionally	☒		☒		☒	
Hatch Framing	☐	☒		☒	Butts	☒	Butts	☒		☒		☒	
Hatch Beading	☒	☒	Corners	☒		☒	Corners	☒		☒	Corners	☒	Corners
Hatch Covers	☒	☒		☒		☒		☒	Flanged & Corners welded	☒	Corners only	☒	Fitting welded on
Oil Tight Hatch Covers	☐	☒	Butts of Bounding Ring	☒	Butts of Bounding Ring	☒	Butts of Bounding Ring	☒		☒	Butts of Rings	☒	Butts of Rings
Pipe Tunnels	☐	☒		☒		☒		☒		☒		☒	
Shaft Tubes	☐	☒		☒		☒		☒		☒		☒	
Door Frames	☒	☒	Frames bent and welded at Butt	☒	Frame bent and welded at Butt	☒	Frames bent and welded at Butts	☒	Angle Mitred and welded at Corners	☒	Frames bent & Butts welded	☒	Frames bent & Butts welded
Attaching Door Frames to Casing	☒	☒		☒		☒		☒		☒		☒	
Doors Watertight	☐	☒		☒		☒		☒		☒		☒	
Doors Non-Watertight	☐	☒		☒	Pressed out of Solid Plate	☒		☒		☒		☒	
Attaching Hinges, Catches etc. to Doors	☒	☒		☒	Riveted	☒		☒		☒		☒	All
Galley Skylights	☒	☒	Work Started	☒	All welded	☒	Work Started	☒		☒		☒	All Complete
Skylights over Accommodation Spaces	☒	☒	Work Started	☒		☒		☒		☒		☒	All Complete
Engine Room Skylights	☒	☒		☒	Stiffener Framing Riveted on	☒	Work Started	☒		☒		☒	All Complete
Engine & Boiler Room Gratings	☒	☒		☒		☒		☒		☒		☒	
Attaching Framing & Supports for Grating	☒	☒		☒		☒	Occasionally	☒	Riveted	☒		☒	
Ladders & Stairs including Rail Attachments	☒	☒		☒	Ladders only	☒		☒		☒		☒	
Screen End Bulkheads	☒	☒		☒		☒		☒	Butts of Bars only	☒		☒	
Bulkheads-Partition Bulkhead in Accommodation Spaces	☒	☒		☒		☒		☒		☒	Bath Partition Bulkheads in Place	☒	Bath Partition Bulkhead welded in Place
Bulkhead Bounding Bars, Butts & Corners welded in Place, O.T. & W.T.	☒	☒		☒	Welded in Place after Riveting	☒	Occasionally	☒		☒		☒	
Bounding Bars, Butts & Corners of Floors, O.T. & W.T.	☒	☒		☒	Welded after Riveting	☒		☒		☒		☒	In Place
Plate & Angle Staples	☒	☒		☒		☒		☒		☒		☒	
Angle Corners	☒	☒		☒		☒		☒		☒		☒	
Angle Collars, Watertight	☒	☒		☒		☒		☒		☒		☒	
Ventilator Vent Pipes	☒	☒		☒		☒		☒		☒		☒	
Ventilator Coamings	☒	☒		☒		☒		☒	Butts welded	☒		☒	
Ventilator Cows	☒	☒		☒		☒		☒	Handles welded on	☒		☒	
Ventilator Angle Rings	☒	☒		☒	Welded at Butt	☒	Welded at Butt	☒	Welded at Butts	☒	Butts	☒	Butts
Attaching Ventilator Angle Rings to Deck	☐	☒		☒		☒		☒		☒		☒	
Attaching Cowl Supporting Rings to Ventilators	☒	☒		☒		☒		☒		☒		☒	
Manholes, Oiltight and Watertight	☒	☒	Butts of Rings	☒		☒	Butts of Rings	☒		☒	Butts of Rings	☒	Butts of Rings
Manholes, Non-Watertight	☒	☒		☒		☒		☒		☒		☒	

Fig. 7

RECORD OF WELDING WORK													
BETHLEHEM SHIPBUILDING CORPORATION LTD.													
PART OR ITEM WELDED	APPROVED BY CLASSIFICATION SOCIETY	FORE RIVER		SPARROWS PT.		HARLAN		MOORE		POTRERO		ALAMEDA	
		OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS	OPERATION PERFORMED	REMARKS
Tack Welding of Floors, Frames etc. for Bull Riveting		☐		☐		■		☐		■		☐	
Attaching Feed Water Heaters to Foundations	■	■		☐		☐		☐		■		☐	
Foundations (other than Boiler and Engine)	☐	☐		☐		☐		☐		☐		■	AFTER WINCH FOUND DYNAMO FOUNDATION WELDED COMPLETE & TO DECK OR FLAT
Valve Guard (Tankers)	■	☐		☐		☐		☐		■		■	All Completely Welded and to Place
Garbage Chutes	☐	☐		☐		☐		☐		☐		■	Completely Welded & Welded to Place
Platform Hangers to Bulkheads in Engine and Boiler Rooms	■	☐		☐		☐		☐		☐		■	Welded in Place
Boom Seatings or Supports	☐	☐		☐		☐		☐		☐		■	Welded to Deck
Deck Pipe Stands (Tankers)	☐	☐		☐		☐		☐		■		■	Completely Welded and to Deck
Tank Stands	■	☐		☐		☐		☐		■		■	Welded to Decks or Flats
Sockets for Boat Davits	☐	☐		☐		☐		☐		■		■	Welded to Deck
Watertight Collars on Longitudinals	■	☐		☐		☐		☐		■		■	Welded in Place All
Supporting Bars for Pump Room Platforms	■	☐		☐		☐		☐		☐		■	Completely Welded in Place
T-Bars on Decks for Cadet Rooms Partitions	■	☐		☐		☐		☐		☐		■	Welded in Place to Deck
Running Light Shields	☐	☐		☐		☐		☐		■	Welded to Bridge	☐	

Fig. 8

building Company's plant at Elizabeth, N. J. In the construction of these skylights, Mr. Ewertz states that no angle-smith or blacksmith work or riveting of any kind was used. As the photographs plainly show, a great deal of material originally used in skylight construction has been eliminated, and yet there is every evidence of strength and rigidity in the construction.

TOWING TARGET FOR THE UNITED STATES NAVY

A large part of the welding done for purely demonstration purposes is of little value to shipbuilding interests. This is noticeably true of the much exploited towing target which was constructed at great expense by one of our Navy Yards, and which had its first sea trials about a year ago. As a demonstration of methods of assembly, welding procedure and process welding, it would have been valuable to constructors obliged to consider costs only as showing them what should not be done. The welded portions might, with equally efficient results, have been fastened together by bolts, as the plating was used merely to form a container for the heavy buoyancy timbers and to furnish a much-needed trimming keel. No reference to watertightness appeared in the specification.

SCHEDULING WELDING OPERATIONS

Like the Wagnerian theme, which that composer threaded through all of his operas, Lloyd's list appears as the foundation of welding operations in practically all of our American yards, and it is only through local conditions, or interpretation by specializing engineers, that modifications appear.

One excellent example of this local interpretation is shown in accompanying reproduction of Record of Welding Work carried out at the different yards operated by the Bethlehem Shipbuilding Corporation (see Figs. 6, 7 and 8). This is a

most convenient method of setting up an otherwise awkward list of details, for it shows at a glance not only what is being welded or not welded at the different yards, but the extent also to which each item is fabricated by that process.

MISCELLANEOUS SUGGESTIONS FOR WELDING

The sketches for various ship fittings and fixtures which may be advantageously welded, as shown in Figs. 9-16, will suggest to the constructor many ways in which he may reduce



Fig. 9

Fig. 10

Fig. 11

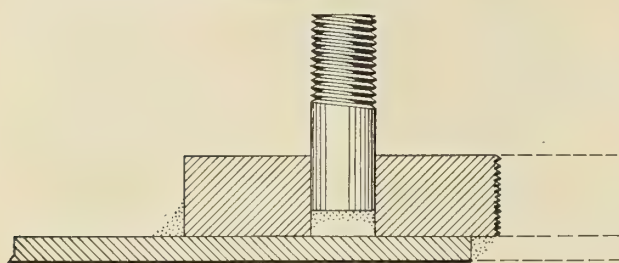
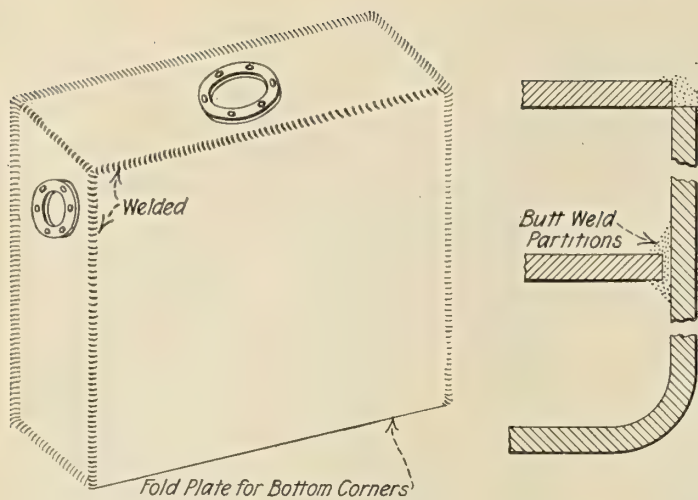
If large single plates are used in the fabrication of deck houses, bulkheads or other structures, the unsupported areas may be stiffened by bar or angle ribs as above:

his weights and costs. Many of these fittings and fixtures are regularly produced by different yards as a part of their standard construction and those in actual use have proven entirely satisfactory.

PLANT MAINTENANCE

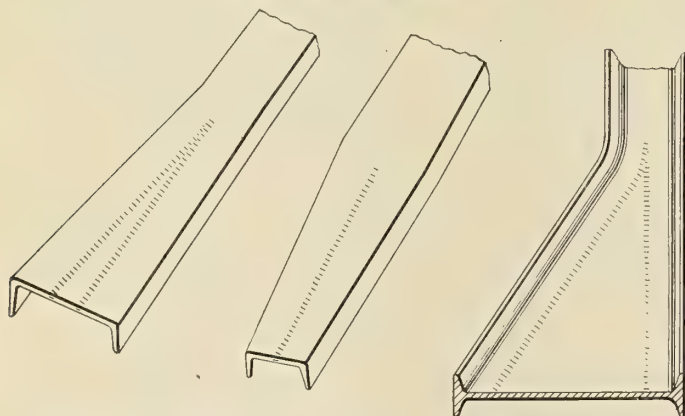
Fig. 17 illustrates an electrically welded break in the side frames of one of the 35-ton yard locomotives operated by the New York Shipbuilding Corporation in its Camden plant. Similar repairs were made in another locomotive of the same type.

These repairs were made some time ago, and while the engines have since been engaged in heavy work day and night,



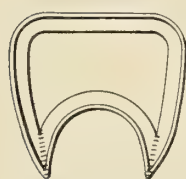
DETAIL OF FLANGE AND STUD

Fig. 12.—Fresh Water Tanks

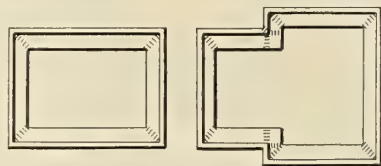


REDUCING CHANNELS

BRACKET FRAME END



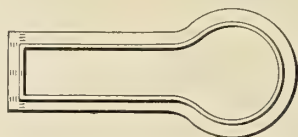
MAST PLATFORM



SIDE LADDER PLATFORMS



W.T. DOOR FRAME



WINDLASS FOUNDATION FRAME

Fig. 13.—Angle Smith Work

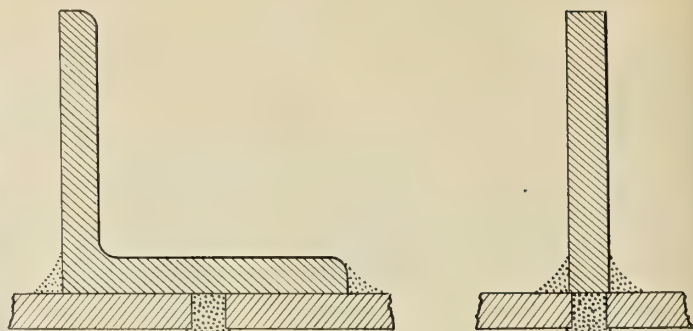
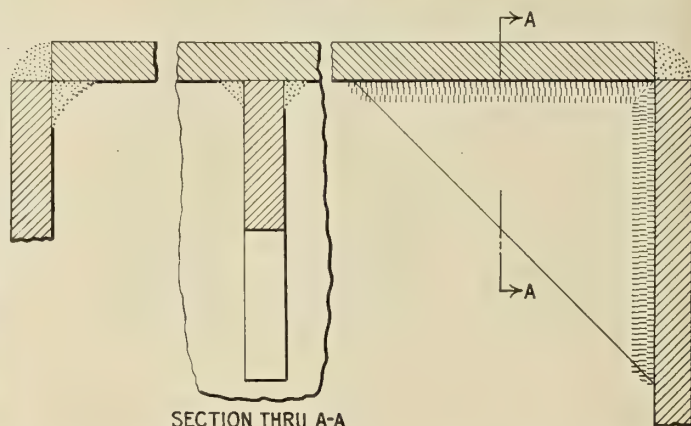


Fig. 14.—If Skylight Casing is Made in Sections, the Plate Edges May Be Butt Welded with Inside Angles Utilized as Backing Straps as Shown Above



Fig. 15.—For End Seams or Other Jointures Occurring Between Landings, the Plate Edges May Be Butt Welded or Butt Strap Welded as Shown Above



SECTION THRU A-A

Fig. 16.—For Skylight Casing Corners it is Recommended That All Angles Be Omitted and Plates Joined as Above. Where Additional Bracing is Required, Small Gusset Plates May Be Inserted at Intervals of 12 Inches or More, and Fillet Welded on Each Side

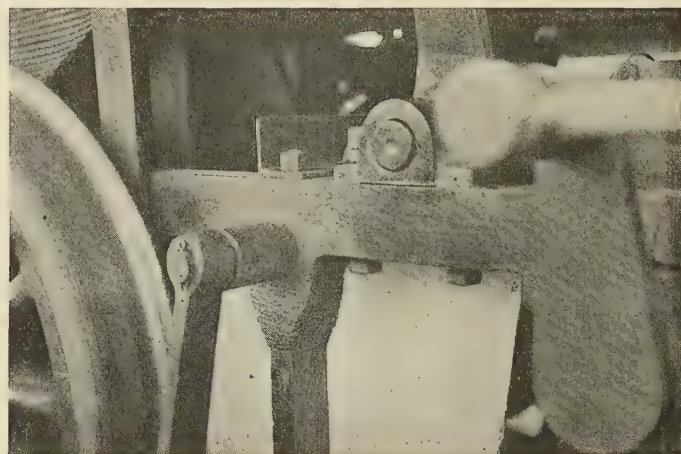


Fig. 17.—Welded Break in Locomotive Side Frame

the welds are holding perfectly sound, notwithstanding they are constantly subjected to severe shocks incident to passing over rough crossings, and, what is even more trying, the strains due to sudden setting of the brakes (note position of brake levers).

Both of above jobs are excellent examples of the great value of electric welding as an adjunct of plant maintenance. With no other expense than that for the labor of chamfering the

edges of cracks for fusing in the new metal, both welds were quickly made and the engines restored to service. By any other method of repair they would have been out of commission many times the number of hours required for welding and the cost would have been very great.

THE SELECTION OF WELDING EQUIPMENT

It is interesting to note the great diversity of plans followed by different shipyards for the supply of their welding current. Thus far many of them appear to have chosen their equipment rather for emergency requirements than for efficient, economical production service. Some have shown very plainly their acceptance of the idea that electric welding is merely a corrective art and, therefore, requires only such equipment as may be carted about the yard to plug up mis-punched holes, fill up cavities in castings and the like. Others, fortunately for their own best interests, appreciate welding as a constructive art and their equipment plainly shows their confidence that it will justify the same careful selection of machines and the same substantial installation as that provided for other equipment of established lines.

A good illustration of the latter is shown in Fig. 18, which shows one corner of the welding shop established by the New York Shipbuilding Corporation for their North Yard. Each of the welding sets included in the photograph is a 175-ampere unit of the most modern and efficient type obtainable. They are designed for low speed service and have an easy overload capacity for operating at 250 or 300 amperes for extended periods, and are therefore capable of caring for any type of welds, whether heavy or light.

In order to meet the demands of shipyard service, the selection of welding equipment presents many problems unheard of in other lines of manufacture. It is not possible to make any installation for field service permanent because of the constantly changing condition of the work on the ways. To meet this condition, some yards select portable machines mounted on trucks, but these have not been found satisfactory, as yard transportation is very different from shop transportation and small-wheeled trucks are of little use.

The portable sub-station has proven about as convenient as any other method, as it meets every condition of semi-permanence and provides storage for such tools and supplies as are immediately required in every-day service. One of these portable stations has been adopted by the Sun Shipbuilding Company at their Chester, Pa., yard. This car has been in service upwards of three years and has proven not only efficient for the purpose for which it was built, but also as an example of welded construction subject to severe test. The car was built entirely of steel, electrically welded throughout.

THE PROGRESSIVENESS OF WELDING

Any suggestion that the more or less generous use of welding by our ship constructors can be taken as an indication of their progressiveness would no doubt be resented by many; nevertheless the implication is pretty generally true.

We regard with awe the remarkable record of the Hog Island yard and the terrific pace maintained by its managers in their efforts to supply Pershing with his bridge of ships. Complaint has been made that the Hog Island venture cost "a mint of money." What if it did? It was well worth the price to learn what brains and enterprise can accomplish, and Hog Island *did things*. In thirty-eight short months they converted a scrubby swamp into a 50-way shipyard, built and delivered 115 completed ships, which, within that same period, have carried considerably more than 3,000,000 tons of cargo to every corner of the globe.

The same critics also object to the Hog Island ships as poorly designed, expensive to operate and maintain, and unseaworthy. It may be so, nevertheless they already have a steaming record of over 3,100,000 ship miles. They have not

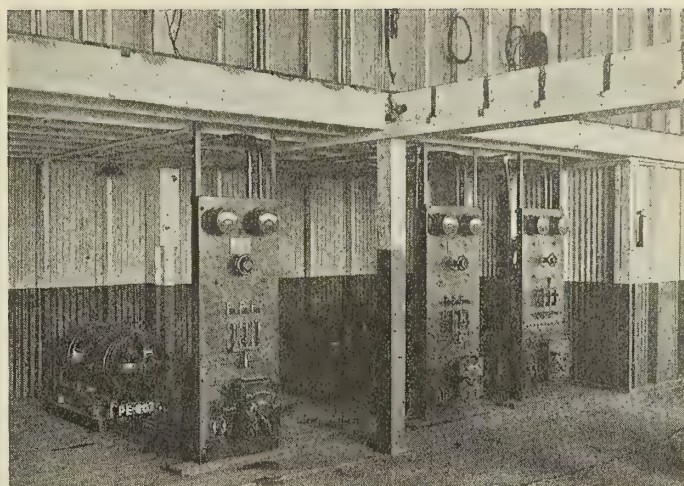


Fig. 18.—Corner of Welding Shop, New York Shipbuilding Corporation

only kept afloat, but hold enviable records for seaworthiness, and the number of "lame ducks" they have rescued on their voyages.

In this connection it is interesting to note that the Hog Island management strongly advocate the use of welding. In fact, they have used it very freely in all of their construction, yet we hear no reports that their welds have failed.

Many instances of the progressiveness of our shipbuilders have been recorded wherein a disposition to accept welding as a constructive measure of undoubted reliability has won glory and profit to them and aided in victory for our Army and Navy. As usual, however, there have been those who see only the seamy side, and, without lifting a hand to assist in eliminating the difficulties, which we know do stand in the way of universal success in the use of welding, they refuse either to try it or speak a friendly word in its favor.

When the shipbuilders learn to accord to welding the confidence as well as the dignity and class which it deserves, and labor also realizes that therein lies hope for a happy solution of their problem of the pay envelope, we shall begin to enjoy the fruits of our contest for its recognition as a productive and a constructive art.

It is all right to use welding for corrective work, as far as it need be so used, but, with apologies to our President, let us hold our men to the same strict accountability for avoiding the necessity of corrections as they were admonished to use prior to the introduction of that handy method, electric welding.

ELECTRIC DRIVE IN THE NAVY.—The electrical operation of the Navy's six new line battle cruisers, now building under the 1916 naval programme, will represent, according to Rear Admiral R. S. Griffin, Chief of the Bureau of Engineering, "The greatest horsepower per shaft that has ever been projected in any marine installation irrespective of the type of motive power." Speaking of these war vessels, and of the six new battleships, also part of the programme, and emphasizing what this means in making the United States pre-eminent among all nations in marine engineering, Admiral Griffin says:

"In the case of battleships Nos. 49 to 54, the installations represent an increase to 60,000 horsepower, that is double the most powerful electric drive installations previously designed, and in the battle cruisers 180,000 horsepower is to be carried by four electrically-driven shafts.

"This," he continued, "is by far the greatest horsepower per shaft, so far as this bureau is aware, that has been projected in any marine installation irrespective of the type of motive power."

Marine Terminals and Port Facilities

BY FLOYD T. SMITH*

A look ahead into the coming year shows many huge port developments contemplated. The Atlantic, Gulf and Pacific coasts are dotted with many cities which have planned improvements. Our larger and much improved merchant marine makes necessary terminals of the latest design or improvements in existing structures that will give a quicker turn around of ships and provide better facilities for both export and import trade.

FACILITIES which the port requires should include good harbors, deep channels, wide piers, warehouses and pier sheds of improved construction to accommodate the shipping which comes to it, but one of the most important of all necessary facilities is the loading and unloading methods and mechanical equipment that permits quick dispatch. Other necessary services which the port should provide are dry docks, repair plants and coal and oil bunkering facilities.

The port grows in direct proportion to the shipping drawn to it. A big asset to any seaport is the ample terminal capacity in which the latest mechanical equipment has been installed and which will compensate for the difference in cost of operation in this port and elsewhere. The chambers of commerce and boards of trade have proven to be public spirited and have shown with results that followed that the many cities were anxious for trade and in a position to take care of it. Naturally the proximity to the ocean is of vital importance, but equally true is it that the terminal facilities of a port somewhat removed from the ocean may be such that a ship could be loaded and unloaded in such time as more than compensated for the extra time required for the same ship to run over the longer distance.

Ports are necessary outlets and inlets for commodities of all kinds. It is a big advantage in regular liners and tramps tying up directly to broad, deep water piers and wharves where they may be loaded and unloaded without resorting to the slow and expensive process of lightering the cargo.

NEED OF PORT DEVELOPMENT

Any city desiring to become recognized as a factor in handling water-borne commerce should give careful consideration to the need of port developments, as plainly outlined by the Montreal Harbor Commission:

"The ports that are doing the biggest business, and doing it most efficiently, are the ports that have kept their facilities ahead of actual requirements.

"The ports that have remained stationary or lost in prestige have been those which neglected to provide facilities before business was forced to seek elsewhere the same facilities provided by rival terminals. Business follows the facilities.

"Unity of authority, concentration of business, depth of water areas and facilities for despatch of business are the prominent characteristics of successful port administration.

"The necessity of providing large and convenient storage areas where cargo may be collected and cared for.

"The lowest cost of handling cargo from the hold of the ship to consignee, and vice versa, was found to be in a port where one authority controlled the entire operation, and where transit sheds were three to five stories high.

"Great port developments have invariably been followed by increase of trade and population."

Congestion, delay and excess cost at a port terminal are shown in the profitableness and eventually in the growth of the foreign trade which passes through it. The cost of moving goods by railway or ship amounts only to a fraction of the cost of handling them through the terminal. It is not possible that further great economies can be effected in either rail or water transportation, but it may be possible to reduce

terminal costs greatly through the use of more modern equipment and the co-ordination of facilities to eliminate unnecessary handling or movement of goods within the port.

THE TRAFFIC PROBLEM

The most vital problem of practically all port terminals is essentially a traffic one. It is either the provision of cargo for ships which otherwise would have to leave in ballast or the securing of markets capable of absorbing the product brought by ships which otherwise would have to go empty. Operating ships in ballast means an operating loss, and ports which cannot assure vessels of cargo both ways are badly handicapped in building up their overseas shipping services.

There are many examples of serious difficulties in this respect among American ports. For instance, the physical volume of imports of material for manufacture, which enter through Boston for use in New England, normally greatly exceeds the volume of export which New England can furnish. To attract shipping lines, therefore, Boston's problem is to secure bulk freight for export from regions outside of New England. At Galveston, cotton exports tremendously overbalance the volume of imports and the same situation may be said to exist in other southern ports. Most American ports have been developed as the terminals of a very few principal railways. Competition among the various ports and the railways which serve them has occasioned many rate wars and disputes. The outcome as regards north Atlantic ports has been the establishment of differential rates on export traffic which favor Baltimore and Philadelphia, as against New York and Boston, a handicap which has seriously hampered Boston's efforts to secure bulk cargo, such as grain, with which to balance her imports. New Orleans, likewise, has secured a preferential rate, approximately that between eastern ports and Chicago and the central part of the country.

There has been considerable agitation as to the advisability of making huge appropriations, and much thought has been given as to whether or not the vast sums expended for important port facilities could be considered a paying investment. Without doubt the results obtained at the huge terminals constructed and in part put into operation during the war period have demonstrated and conclusively proven what modern equipment could accomplish. The terminals so equipped were the army supply bases at Boston, Brooklyn, Newark and Norfolk.

HUGE SUMS TO BE EXPENDED BY PORTS

The total amount to be invested by ports themselves or by private interests will in many harbors greatly exceed pre-war figures. New York City, one of the great war ports, even now at the expenditure of tens of millions of dollars has no adequate permanent docks for proper handling of cargo ships and great quantities of cargo, excepting, of course, the Brooklyn Army Base and Bush Terminal. Boston, Philadelphia and Baltimore greatly benefited by great expenditures during the war. Philadelphia with her municipal piers has gained the reputation of being well equipped. New Orleans was the only gulf port in which extensive port improvements were

* Power and Mining Department, General Electric Company, Schenectady, N. Y. Member, Terminal Engineering Society; associate member, American Institute of Electrical Engineers.



Fig. 1.—A Ship from the Orient with a Two-Million-Dollar Cargo, Bush Terminal

made. Mobile and Galveston are so favorably situated that a great deal may be expected of them in the future as world shipping ports. The Pacific Coast of the United States is one of the few sections of the world provided by nature with commodious harbors. Puget Sound on the north is a great inland sea with about 1,500 miles of coast line. No dredging is required for ship channels, and this is an asset of prime importance. San Francisco Bay is a harbor second only to Puget Sound. Seattle ranks first in the commerce of the Pacific Coast ports, first in the huge port terminals, just completed, and first in material handling equipment. Our several Great Lake port terminals are world renowned as examples of ports with efficient mechanical apparatus for bulk cargo handling.

It has been said that New York handles material in a similar manner to that used a century ago. This is true, but the plans that have been made for intended improvements very clearly show that the thought uppermost today is that the old equipment must go or be improved and that new must be built. Just as New York has been the most backward of ports in making the most needed improvements, so now it would appear it is the most forward in the large future developments contemplated. At least three huge terminals in New York Harbor will be built. They will be located at Staten Island, Weehauken and Greenville.

\$25,000,000 TERMINAL ON STATEN ISLAND

The Staten Island development has been started. There will be fourteen great modern ocean piers which are now in the course of construction at an estimated cost of twenty-five million dollars. This sum is provided by a serial issue of bonds. So great has been the demand for adequate port facilities that every one has been leased advantageously, in advance, for a period of thirty years. These fourteen piers will take care of a great deal of the transatlantic traffic, which, at the present time, is unable to find adequate accommodation.

For the vast bulk of freight destined for distribution to

points south of the Hudson, and westwardly through the range of states bordering the Great Lakes and for freight originating in these sections for trans-shipment abroad, these movements will in the future be handled very largely on the New Jersey side of the harbor. This would indicate a very favorable location for the terminal on Staten Island.

Unfortunately, one of the most striking features of the layout of the Staten Island piers is their extreme narrowness compared with modern piers in other ports. All of the Staten Island piers except two are about 125 feet wide. In the opinion of many port engineers this may prove to be a very serious error, which later results will verify. Another feature is the failure of most of the piers to take advantage of the opportunity afforded by the proximity of the Baltimore & Ohio Railroad tracks in their rear to make direct rail connection between them and this important trunk line railroad. When we consider that perhaps 75 percent of the import freight arriving in New York Harbor is destined for transfer into the interior of the country by rail, and that an equal proportion of the export freight arrives by rail, this lack of pier tracks would indicate a vital point overlooked. Some of the piers will be provided with cranes for cargo loading and unloading and for monorails, hoists and other equipment inside the pier sheds. On the other piers not so equipped the wise pier operator who has learned many a practical lesson in these days of increased cost and decreased efficiency will no doubt provide, wherever possible, modern freight handling equipment.

EQUIPMENT OF CUNARD PIERS

The Cunard Steamship Company has acquired 3,600 feet of shore frontage at Weehauken, N. J., on the North River opposite New York on which it is proposed to erect eight steel concrete double decked piers 1,000 feet by 158 feet wide. There is to be a five-story reinforced concrete warehouse, a feature of which will be enormous operatorless elevators, capable of carrying a number of loaded trailers. Speed in vessel loading and unloading is paramount and mechanical handling is the secret of efficiency.



Fig. 2.—Piers A and B, Smith Cove Terminals, Seattle, the Two Largest Piers in the United States. Pier B, in

The purchase of cargo handling equipment will embrace the most modern appliances for the economical and expeditious handling of cargo. Tractor and trailer service will be used extensively. Cranes for the extensive cargo operations will be installed in large numbers and the entire layout will doubtless represent the latest creations in terminal development. By the building of this modern freight terminal the Cunard Line's vessels will avoid the congestion in the port of New York and will connect direct with the principal railroads. The expense and delays due to the present long lighterage hauls will thus be dispensed with.

MAINE PROJECTS

Portland, Me., the "Sunrise Port" and the most eastern of our large terminals, is also planning development. In order that the harbor facilities at this port might be made available for the other rail lines entering there, as well as the Grand Trunk, plans are now under way for the erection of a concrete and steel state pier and permission to extend the harbor lines 500 feet at the site of the proposed state pier and the Grand Trunk piers has been granted by the War Department to the city of Portland. The several steamship lines that have not heretofore utilized the port have investigated the proposed facilities and have signified their desire to make use of the same when available.

BALTIMORE'S PORT DEVELOPMENTS

Baltimore's natural facilities include a large land locked harbor, dredged to 35 feet. Baltimore is the most western of the eastern ports, the most northern of the southern ports and the most southern of the northern ports. It is only a question of time until this port's facilities will be unable to handle the volume of traffic concentrated there or accommodate the vessels seeking berth space. The apprehension among steamship operators is that if the foreign trade of the United States should in the near future expand considerably, which may safely be assumed as inevitable, and if Baltimore should par-

ticipate in this expansion to any great extent, which she will, the shortage of wharfage would be acute and would warrant the expenditure involved by them in leasing such facilities.

Within the past few years the city of Baltimore has expended about three million dollars for deepening the channels in the harbor and over nine million dollars for public wharves, docks and marginal streets. In addition to this, the Maryland Legislature has this year passed an act empowering the city of Baltimore to borrow fifty-two and one-half million dollars to be applied to the construction of wharves, docks, piers, warehouses and other waterfront development. The first instalment of ten million dollars of the fifty-two and one-half million dollars loan has been ratified by the people of Baltimore and within a very short time the first of this huge development programme will be started.

SOUTHERN PORTS

The city of Norfolk has taken over, under contract with the War Department, a portion of the army supply base and is operating pier No. 2. In the harbor, the city of Portsmouth is proposing to spend \$3,500,000 in the construction of municipal docks, piers and warehouses. The plans include provisions for two piers, two warehouses and the building of railway connections so as to facilitate shipments from the public docks at Pinner's Point. The proposed piers will each be 1,200 feet in length and the warehouses four stories in height with an enormous ground space.

Although the port of Philadelphia may be said to be well equipped, still to take care of future import and export trade the port plans an enormous development estimated at many millions of dollars for piers and dock construction, the programme including cranes, hoisting and conveying and other necessary machinery. Immediate construction estimated at \$11,000,000 is to include new piers, each 1,200 feet long by 300 feet wide, with machinery installation. Other work will include the construction of similar structure at the Moyamensing pier group.



the Immediate Background, Has Since Been Completed and Passenger Sheds Built Close to the Street Side

PACIFIC COAST DEVELOPMENTS

On the Pacific Coast the increase in the population of coast cities, the near future influence of the Panama Canal, the many absolutely necessary new routes of trade to the Orient, together with the surety of more manufacturing being carried on in the future of the coast, all demand the location of a real terminal in San Francisco Bay. With this in mind, plans for a multiple story ocean and rail warehouse terminal in San Francisco have been approved by the Board of State Harbor Commissioners.

The improvements will cost approximately \$2,300,000. The creation of an industrial property and the erection of a six-story warehouse will take care of the seasonal as well as transient cargoes on the north side of the channel at China Basin. Belt railroad tracks on the wharf and behind the warehouse will be constructed and such other tracks as may be necessary adequately to serve the property. Improvements on the south side of the channel will provide a berth 830 feet in length.

The plans adopted combine a railroad and ship terminal, to be used as either. The terminal will include concrete warehouses and facilities for light manufacturing, a freight storage yard, transfer platforms, switching and team tracks, driveways and freight sheds. It will be used as a place for the accumulation of freight, to minimize idle time of ships and cars.

With facilities offered for the rapid handling of freight, it is the purpose of the plan that a ship can be unloaded as rapidly as stevedores with the aid of modern machinery can perform, and then warped into another berth, loaded and sent to sea. It is also the purpose of the plan to unload freight cars and subject them to as little delay as possible. The development will include harbor works, warehouse and factory development, worked out in an ideal way, which will require many years for production in its entirety, but the plan, however, is arranged so that a beginning may be made along the waterfront immediately and so that each unit will operate independently of the others, and that it may be increased

gradually upon exact lines in the future by adding units toward the completion of the whole.

SEATTLE THE BEST EQUIPPED PORT

Seattle, the metropolis of the Pacific northwest, and now the best equipped port, has practically completed its ocean terminal. Noteworthy during the year was the completion of the work on piers A and B, Smith Cove terminal, and the public terminal system now claims the two largest cargo piers in the world. Pier A, distinctly a freight terminal, has the most complete mechanical appliances of any single dock on the coast. Pier B is the largest commercial pier in the world, being 2,543 feet long and 365 feet wide, with a berthing space for eleven ocean-going ships. With the idea of service in mind, the piers are equipped with mechanical devices with a range of capacity for the handling of a small case of salmon weighing 70 pounds to a locomotive weighing 100 tons.

The great gain of directly operating these publicly owned terminals as a business concern lies in the fact that the terminals are open to all commerce. A ship can sail into the harbor of Seattle from any place in the world, can secure a berth at one of these publicly operated docks without any cost whatsoever for berthing. When one compares this situation with conditions in other ports where steamship lines are paying many thousands of dollars each year for narrow and inefficient terminals, one can readily appreciate the significance of a port with such facilities.

The port of Astoria, located on a peninsula between Youngs Bay and Columbia River, is well situated for extensive ocean commerce. Here during the past year another modern terminal has been constructed and put in operation. The total berthing space of the two piers will be 11,700 linear feet. These piers are served by the Spokane, Portland and Seattle Railroad with a direct connection to the interior by a water level grade. This terminal has the proud distinction of being well equipped with material handling devices and the design and construction permit the ready operation of all in connection with the railroads for quick loading



Fig. 3.—The National Terminal at Boston, Mass.

and unloading. Award has been made for still further construction to consist of pier No. 3 and a freight shed, which shows the foresighted planning of the port of Astoria commission.

The first unit of development for the port of Tacoma will comprise dredging and filling and the construction of an open storage pier for the handling of lumber and miscellaneous open storage cargoes, a transit shed for the handling of ocean-going ships and cargoes, and railway and railroad connections. The open storage pier constructed under the first unit of development will have a length of 800 feet and a width of 166 feet, with a further extension amounting to a total width of 266 feet and a length of 1,200 feet. This pier will be equipped with hammerhead cranes for the quick handling of lumber from barges to storage and from storage to ship's tackle. The transit shed on pier No. 2 will be 1,000 feet in length by 180 feet wide, with an open wharf 35 feet in width on the slip side, containing two railroad tracks. The outside of the shed will be equipped with semi-portal gantry cranes for handling cargo to and from ships and the interior of the shed will be provided with monorail hoists for the distribution of cargo inside the shed.

EXPENDITURES AT NEW ORLEANS

The Louisiana Legislature has recently passed a bill authorizing the Board of Commissioners of the port of New Orleans to issue \$6,500,000 more in bonds for the improvement of the port. Most of this amount will be provided to increase the number of wharves on the river front, as wharfage now is so scarce that from three to fifteen vessels are tied up in the stream at all times awaiting the opportunity and space to unload and load cargoes. It is also planned to start work on the first unit of the development near the Catalina Island steamship terminal.

ON THE GREAT LAKES

Plans have been approved for a water and rail terminal for Milwaukee. From the present breakwater six piers will be built, each 700 feet long and 300 feet wide. The docks will be of cement and equipped with the most modern machinery for handling freight. Double railroad tracks will be laid along the sides. Back of them will be four warehouses. Cranes will lift freight from the vessels. The docks north of the harbor entrance will be used principally for package freight bound to and from Milwaukee. The filled in land at the west end of the docks will be occupied by warehouses and railroad tracks.

IMPROVEMENTS FOR HANDLING BULK FREIGHT

This outline has been descriptive of terminals and piers for the handling of so-called package freight, but something should be said of the contemplated improvements for the handling of bulk material. Such a layout is naturally of entirely different type. In the terminals briefly described all of the commodity passes in or out of the ship's hatch by slings and crane or by an unloader, and the unloading and loading operation is far from being as continuous in performance as that used in the handling of bulk material. The so-called L.C.L. freight of less than car load lots or types of package freight must necessarily be carefully stowed in loading, requiring time and money. Similarly, in unloading, the commodity is loaded onto a car or onto some type of apparatus for movement to temporary or permanent storage in warehouse or pier shed.

For bulk or free flowing freight the material in loading is run or conveyed into the ship in practically a continuous stream and later mechanically trimmed. Immense mechanical coal and ore unloaders make a ship's stay in port a short one. Such loading and unloading terminals for bulk freight are generally the outlets of railroads and the locations have naturally been on the Atlantic coast or the Great Lakes. Two large railroads are now planning, on the Atlantic coast, new bulk material handling terminals of this kind.



Fig. 4.—Hulett Ore Unloaders at the Ohio and Western Pennsylvania Dock Company, Cleveland, O.

The harbor facilities of the Lehigh Valley Railroad plans the construction of a new rail and deep water terminal in the Greenville section of Jersey City and on New York Harbor. The plans provide for three of the largest piers in the world. When completed, the piers will provide dock space six miles long.

LEHIGH VALLEY PLANS LARGEST PIERS IN THE WORLD

The first unit of the new terminal will replace the company's ore pier at Constable Hook, supplementing the company's pier at "National Docks" at Black Tom and Tide Water Basin Terminal in Jersey City. Cars will come to ship's side direct, provision being made on the piers which will be respectively 400, 550 and 350 feet wide for both storage and classification tracks. Slips between the piers will be 550 feet wide at the pier heads, tapering inshore to a minimum width of 450 feet. This feature is expected to facilitate handling of ships in and out of the slips, making it possible to navigate the slip channels while other vessels occupy berths on both sides.

The piers will carry large warehouses, open docks and storage space and will be fully equipped with traveling revolving gantry cranes and other mechanical freight handling machinery for handling heavy freight and for unloading ore. Pier No. 1, now under construction, will comprise an open



Fig. 5.—Pier Shed Showing Many Kinds of Freight to Be Handled

pier dock 720 feet long, an open storage space served by gantry cranes, a warehouse, and further outside an ore dock equipped with four unloaders for unloading ore from boats into cars at the estimated rate of one car per minute. Two 600-foot, 20,000-ton boats may be docked at one time at the unloaders, two at the warehouse and a fifth at the open dock. The open pier and warehouse docks are connected with the railroad receiving and storage yard having a capacity of 250 cars. A warehouse is being planned to provide for both storage and the classification of export and import freight.

Several original and interesting features in design are embodied in the new coal pier for the Western Maryland Railroad Company at Port Covington, Baltimore Harbor. The pier will be 792 feet long and 74 feet wide. Though differing in operation from either the electrically operated piers of the Pennsylvania Railroad Company or the Baltimore & Ohio Railroad Company in this harbor, electrical operation will be adopted throughout and the company's old power plant and steam operated barney abandoned. Situated on this pier will be erected the largest electrically operated coal dumper of this type in the world. The dumper, of steel construction, will stand approximately 118 feet high. It will have a loading capacity of twenty-five to forty huge 55-foot length, 110-ton coal cars per hour.

FUTURE PROSPECTS

Space does not permit a detailed description of the plans for many other ports that realize the need and advantage of

port improvements and are planning well for the future. We could mention the plans of the Gulf ports of Mobile and Tampa; of another coal pier for the Virginian Railway at Norfolk; of the improvements to the Charleston waterfront; of terminal and industrial sites for Savannah; of improvements for Lake cities of Buffalo, Cleveland, Detroit, Chicago and Duluth. In fact, it seems the future has never held so many plans for port developments. A plan to rebuild every harbor and port along the Atlantic coast from Maine to Galveston and to install new freight handling machinery to do much work now done by men has been suggested in a resolution adopted by the Southern Traffic League at its recent meeting in Galveston. This would involve the expenditure of many millions and introduce machinery and labor saving devices.

A wise man profits by the experience of others. The latest constructed ports now operating show thought and clever engineering in their design. May the ports so vital to our country that are now planning and building be the outcome of the wise experience of the past, the best practice of the present and the hope and dream of the future.

Thornycrofts Launch Their Third Post-War Steamer

ON November 16, 1920, Messrs. John I. Thornycroft & Company, Ltd., launched at their Woolston shipyard their third cargo steamer within the past few weeks. This was the *Ville de Dannemarie*, building to the order of Messieurs Le Groupement Industriel de Charbons et de Transports, Rouen, France. The vessel, which was designed by her builders, is of the firm's standard well deck with raised quarter deck type. Her principal dimensions are: Length between perpendiculars, 240 feet; breadth, molded, 36 feet; depth, molded, 18 feet 6 inches; draft, 16 feet 9 inches, and her deadweight tonnage about 2,000. She is built of mild steel to Lloyd's requirements for a 100 A-1 class cargo steamer. The vessel's two cargo holds, one forward and the other aft, contain a combined capacity of 90,000 cubic feet, while coal bunkers for 150 tons are also provided. Water ballast is carried in the cellular double bottom and in fore and aft peak tanks.

PROPELLING MACHINERY

The propelling machinery, constructed in Messrs. Thornycroft's engine works, consists of triple expansion engines having cylinders 18 inches by 30 inches by 50 inches diameter by 33 inches stroke, developing 900 indicated horsepower and giving the ship a speed of $9\frac{1}{2}$ to 10 knots. Steam is generated in two Scotch boilers each having two furnaces. These boilers are each 10 feet 6 inches in length, 13 feet 2 inches in diameter, and provide a working pressure of 180 pounds per square inch. The $7\frac{1}{2}$ -inch circulating pump is supplied by Messrs. Drysdale. The general service pump and the auxiliary feed pump, each $6\frac{1}{2}$ inches by $4\frac{1}{2}$ inches by 6 inches, supplied by Messrs. Carruthers, are of the duplex type, while the Mumford duplex ballast pump is 8 inches by 9 inches by 8 inches.

CARGO HANDLING EQUIPMENT

The cargo handling equipment consists of four 7-inch by 10-inch steam winches by Messrs. Rogers; two are placed in the forward part of ship and two aft. Four large cargo hatches equipped with eight $3\frac{1}{2}$ -ton derricks of pitch pine facilitate the rapid handling of the coal or general cargo which the ship is destined to carry.

Accommodation for the captain and officers is provided amidships, while that for the crew is arranged in the fore-castle. It is expected that this ship will be completed and ready for delivery to her owners in about six weeks' time.

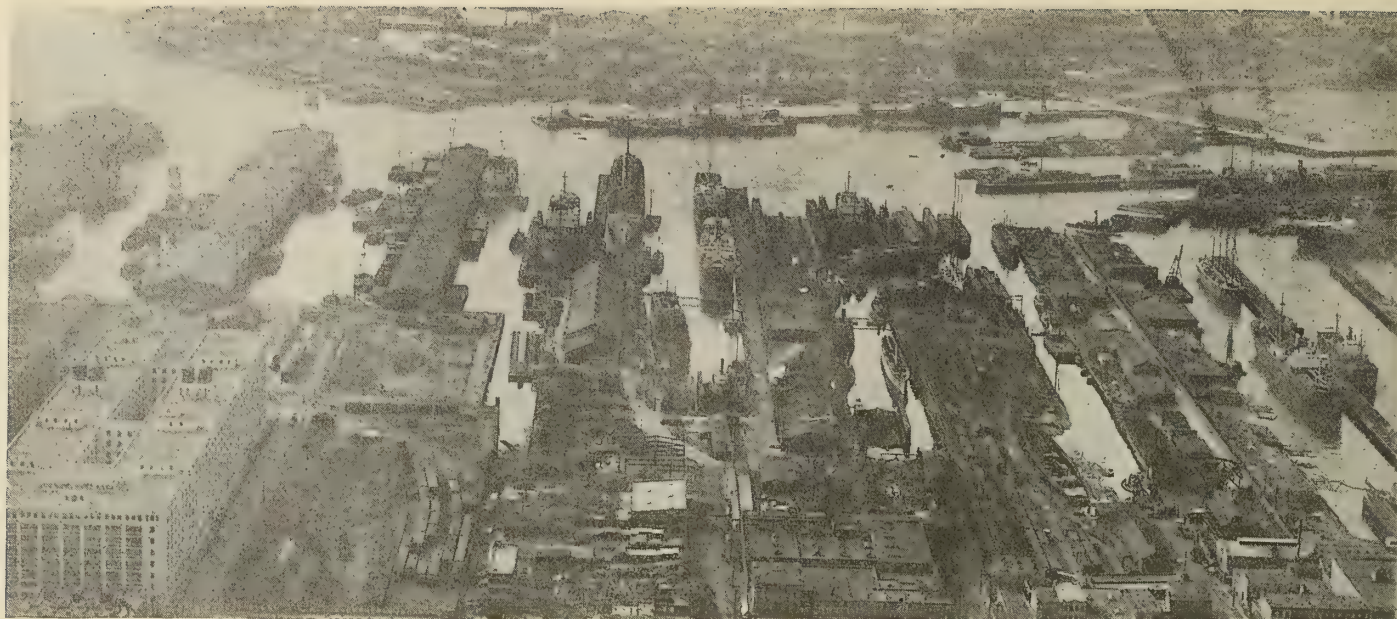


Fig. 1.—Repair Plant of James Shewan & Sons, Inc., Brooklyn, N. Y.

Ship Repair Facilities in the United States

A Summary of the Ship Repair Facilities Now Available for the Maintenance of the American Merchant Marine

ONE of the greatest lessons brought home to the people of the United States during the recent world war was the absolute necessity for the creation and development of an adequate merchant marine. The two basic requirements necessary for the construction and upkeep of a merchant marine are, first, shipyards, a well-known fact, and, second, an extensive and well-balanced system of repair facilities, a fact often lost sight of.

In the short space of three years the United States, aroused to action, has completed a shipbuilding programme that is without precedent in the history of the world and has placed itself in an admirable position to take over the share of the world's commerce to which it is entitled.

In view of the fact that the great fleet cannot maintain its efficiency for any length of time without ample provision for rapid dry docking and repairing, a study of the facilities for carrying on this work in the United States is considered timely and of the greatest importance. The following, therefore, is a summary of facts which result from a study of this kind.

BOSTON

Traveling south along the Atlantic seaboard from the northernmost point of the country, the first principal shipping port equipped with extensive repair facilities is the port of Boston, Mass.

There are seven ship repair yards in the vicinity of Boston equipped for repairing sea-going vessels. The largest of these is the Fore River plant of the Bethlehem Shipbuilding Corporation, Ltd., located at Quincy, Mass. The yard is fully equipped for undertaking repairs of the largest nature, the only limitation being bottom jobs which are limited to the capacity of a 10,000-ton floating dry dock.

NEW YORK

Traveling south from Boston, the next principal shipping port is New York. As New York is the principal seaport of the United States, it is only natural that repair yards abound in this locality. Such is the case, and no less than twenty-

seven plants equipped for carrying out repairs to sea-going vessels are located in this vicinity.

TODD SHIPYARDS CORPORATION

The Todd Shipyards Corporation, the largest ship repair organization in the world, maintains four repair plants in the vicinity of New York City, which are equipped for handling repairs of any magnitude. Of these there are three, the Robins Dry Dock and Repair Company, Tebo Yacht Basin Company and Clinton Dry Docks, Inc., located in Brooklyn, and one, Tietjen and Lang Dry Dock Company, located in Hoboken, N. J.

In addition to the above, the Todd Corporation maintains two yards on the Pacific coast, i. e., Todd Dry Dock and Construction Corporation, Tacoma, Wash., and Todd Dry Docks, Inc., Seattle, Wash.

The united resources of the Todd yards and plants comprise more than 200 acres of land and water equipped with the following facilities:

- 2 graving docks
- 19 floating dry docks
- 25 piers
- 110 shops
- 8 power plants
- 10 service vessels and floating equipment.

Each plant is a unit and every vessel obtains unit treatment precisely as if it were the only vessel in a yard devoted entirely to it.

The facilities of the Todd plants are complete to such a degree that no work is too great but that it can be undertaken and completed with dispatch.

SHEWAN REPAIR YARD

The largest single repair plant in the port of New York is that of James Shewan and Sons, Inc. This plant, which is located at the foot of 25th, 26th, 27th and 28th streets, South



Fig. 2.—Robins Plant of Todd Shipyards Corporation, Brooklyn, N. Y.



Fig. 3.—Tebo Yacht Basin Plant of Todd Shipyards Corporation, Brooklyn, N. Y.

Brooklyn, covers over 45 acres of land and water and is completely equipped as follows:

- Boiler shop
- Machine shop
- Power plant
- Air compressor plant
- Pipe shop
- Coppersmith, tinsmith and plumbing shop.
- Electrical shop
- Blacksmith shop
- Saw mill, joiner, carpenter and pattern shop
- 4 floating derricks ranging from 10 to 40 tons capacity
- 4 ocean-going tugs for moving and shifting vessels
- 4 steam launches for taking workmen to vessels anchored in the stream

THE LORD DRY DOCK CORPORATION

Another large repair yard which promises to be an important factor in New York is that of the Lord Dry Dock Corporation. This company absorbed the business and equipment of the Weehawken Dry Dock Company in April, 1920, and since that time has been actively engaged in developing the 88 acres of plant involved along modern lines. This work is well under way and includes 2,000 feet of bulkhead, five 1,000-foot piers, and dry docks of capacities ranging from 1,000 to 10,000 tons.

DELAWARE RIVER DISTRICT

Moving south from New York along the Atlantic coast the next important shipping port is Philadelphia. Philadelphia is the center of what is known as the Delaware River dis-



Fig. 4.—Lord Dry Dock Corporation Plant in Process of Construction at Woodcliff, N. J.

- 4 twin unit electric welding barges
- 2 air compressor barges
- 1 special barge for furnishing steam and applying water pressure to boilers
- 1 fully equipped fire boat

Ample berthing facilities are provided which allow forty vessels to be accommodated with a mean draft of about 35 feet.

The plant is surrounded by water piping to which a high pressure service is attached. These high pressure pumps are located on the pier and are automatically operated so that a water pressure of about 125 pounds is available at any point in the plant.

Large stocks of material for repairs are carried and 5,000 tons of plates and angles are kept on hand at all times.

Ten dry docks, ranging from 700 to 12,000 tons capacity, make this yard one of the most up-to-date and complete repair plants in the world and railroad sidings connecting with Bush stores and the Delaware, Lackawanna and Western Railroad, provide a ready means for handling stores and material direct to the work.

trict and there are 12 plants equipped for ocean-going ship repair work in this vicinity. The largest of these are the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa., the Sun Shipbuilding Company, Chester, Pa., and the Bethlehem Shipbuilding Corporation, Ltd. (Harlan plant), Wilmington, Del. These yards are fully equipped for undertaking major repairs of any description except bottom jobs exceeding the capacity of their dry docks as given in Table I.

CHESAPEAKE BAY DISTRICT

The next important shipping center south of Philadelphia is what is known as the Chesapeake Bay district with Baltimore and Norfolk as the principal seaports. Ten repair yards are located in this district with facilities for repairing and overhauling large sea-going ships. The largest of these are as follows: The Newport News Shipbuilding and Dry Dock Company at Newport News, Va.; Baltimore Dry Docks and Shipbuilding Company, which maintains three repair plants at Baltimore, Md.; the Globe Shipbuilding and Dry Dock Company at Baltimore; the Sparrows Point plant of

the Bethlehem Shipbuilding Corporation, Ltd., at Sparrows Point; the Union Shipbuilding Company at Baltimore. The above yards are exceptionally complete in every respect and possess, with the exception of bottom jobs on vessels exceeding the capacity of their dry docks, facilities which enable them to undertake repairs of any nature on the largest ships afloat.

SOUTH ATLANTIC DISTRICT

South of the Chesapeake Bay district there are two principal seaports along the Atlantic coast which boast of ship repair plants with docking facilities for average size vessels. These are Charleston, S. C., and Jacksonville, Fla.

The Charleston Dry Dock and Machine Company maintains an exceptionally complete repair plant located on the Cooper River at Charleston, S. C. There is an ideal bay at this point, and this, coupled with the fact that there is 30 feet depth of water, makes this an important yard. Their largest dry dock is one of the floating type of 8,500 tons capacity.

At Jacksonville the Merrill-Stevens Shipbuilding Corporation engages in the construction and repairing of steel vessels. The Merrill-Stevens Corporation is well equipped for doing major repairs and is also located on deep water. There are two dry docks operated by this corporation, one of 4,500 and the other of 6,500 tons capacity.

GULF DISTRICT

The Gulf district is well served with 10 repair yards located along the Gulf of Mexico from Key West to Galveston. The largest of these are as follows:

The Bruce Dry Dock Company, Pensacola, Fla.

Alabama Dry Dock and Shipbuilding Company, Mobile, Ala.

Jahncke Dry Dock and Ship Repair Company, Inc., New Orleans, La.

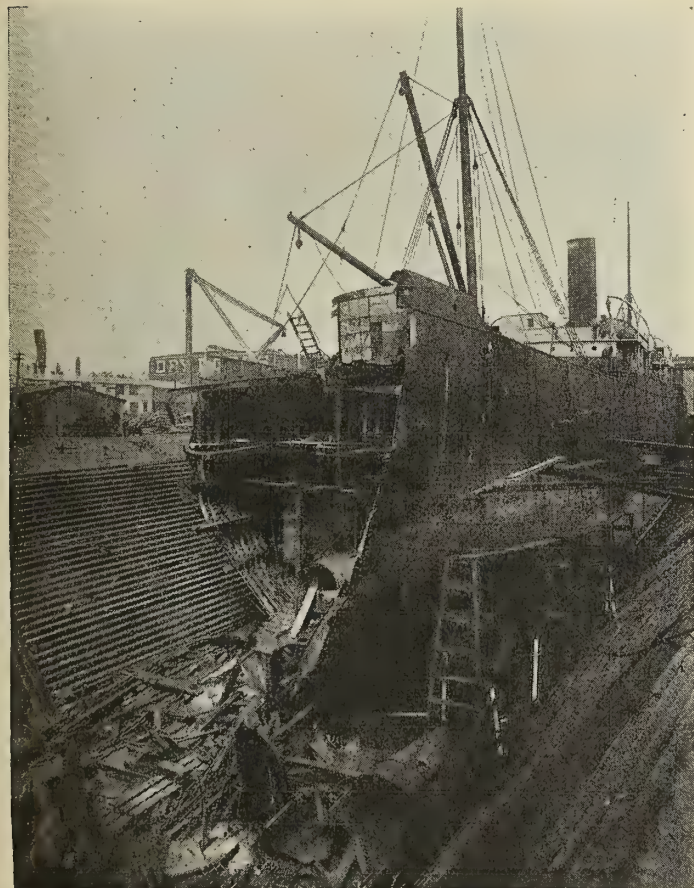


Fig. 5.—Rebuilding Damaged Vessel at Robins Dry Dock

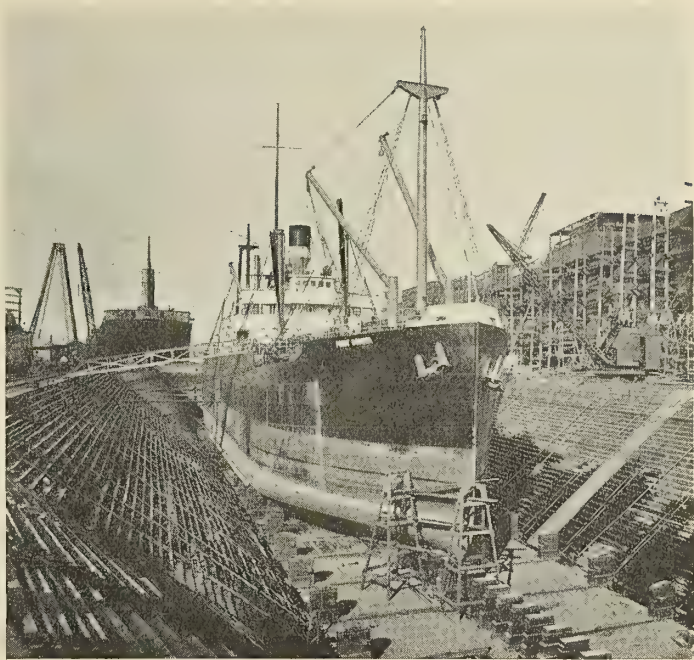


Fig. 6.—Pacific Mail Steamship *Point Bonita* Undergoing Repairs in the Lower Dry Dock, Baltimore Dry Docks & Shipbuilding Company

Johnson Iron Works, Dry Dock and Shipbuilding Company, Inc., New Orleans, La.

Galveston Dry Dock and Construction Company, Galveston, Texas.

The above yards are equipped for undertaking major repairs on the average size sea-going vessel, the Alabama Dry Dock, Jahncke Dry Dock and Galveston Dry Dock companies having dry docks up to 10,000 tons capacity, the Bruce Dry Dock Company up to 6,000 tons, and the Johnson Iron Works up to 5,000 tons.

SOUTH PACIFIC COAST

On the Pacific coast the southernmost repair district is the port of Los Angeles. The largest yards in this district are the Los Angeles Shipbuilding and Dry Dock Company, of San Pedro, Cal., which maintains a 12,000-ton floating dock, and the Long Beach Shipbuilding Company, of Long Beach, Cal., which operates a 3,500-ton floating dock.

SAN FRANCISCO

North of the port of Los Angeles the next principal district is that of San Francisco. San Francisco is the principal seaport on the Pacific coast and there are four large and complete repair plants in this locality which are in a position to undertake repairs of any magnitude. These are the Barnes and Tibbitts Shipbuilding and Dry Dock Company, of Alameda, Cal., the Union plant of the Bethlehem Shipbuilding Corporation, Ltd., of San Francisco, Cal., the Hanlon Dry Dock and Shipbuilding Company and the Moore Shipbuilding Company, of Oakland, Cal.

SEATTLE DISTRICT

The next district, north of San Francisco, with extensive ship repair facilities is known as the Seattle district. In this locality the largest repair plants are the Todd Dry Dock and Construction Corporation at Tacoma, Wash., and the Todd Dry Docks, Inc., at Seattle, Wash. There are no dry docks at the former yard, but the Todd Corporation maintains and operates three at the latter, there being one of 4,000 tons and two of 12,000 tons capacity each.

GREAT LAKES DISTRICT

There is one more section of the country in which are located some large and up-to-date repair plants, and this is known as the Great Lakes district. The Great Lakes form

an important link in the transportation scheme of the United States and many thousands of tons of shipping are carried annually over these waters in vessels ranging up to 600 feet in length and 12,000 tons deadweight carrying capacity.

The American Shipbuilding Company is the largest ship repair company operating on the Lakes and maintains seven plants containing a total of 15 dry docks. These are located at Cleveland, Ohio; Lorain, Ohio; Detroit, Mich.; Chicago, Ill.; Buffalo, N. Y.; Milwaukee, Wis., and Superior, Wis.

Another of the larger organizations on the Lakes is the Great Lakes Engineering Company. This company owns and operates two repair plants, one being located at Ashtabula, Ohio, and the other at River Rouge, Mich. The former is equipped with a graving dock 600 feet long and the latter with two floating dry docks of 1,700 and 8,000 tons capacity respectively.

Other large repair companies equipped for making major repairs to large vessels are the Manitowoc Shipbuilding Cor-

poration, of Manitowoc, Wis., and the Toledo Shipbuilding Company, of Toledo, Ohio.

In the outline given above the outstanding fact is that the United States is not only equipped to carry on the work of keeping its merchant fleet in repair, but that these plants are distributed in a manner that is highly satisfactory. Up-to-date yards fully equipped with modern appliances for carrying on ship repair work are already at hand, but as time is a very important feature in this work there is room for expansion, particularly in the matter of increasing the dry docking facilities.

The foregoing is a summary of the largest repair yards in the country equipped with dry docking facilities and able to undertake repairs of any nature. There are many more, however, which are in a position to do general repair work.

A complete list therefore of repair yards for ocean and lake service has been prepared and is presented in Table I, the information being divided by states and arranged alphabetically.

TABLE I.—SHIP REPAIR PLANTS OF THE UNITED STATES

REPAIR PLANT AND LOCATION.	MARINE RAILWAYS. CAPACITY IN TONS.	FLOATING DRY DOCKS. CAPACITY IN TONS.	GRAVING DOCKS. DIMENSIONS	SHOPS.	SPECIALIZE IN REPAIRS TO
Alabama					
Alabama Dry Dock & Shipbuilding Company, Mobile.....	1,200 200	10,000 3,400 980 428		Machine Shop. Plate & Boiler Shop Welding Shop. Woodworking Shop. Paint Shop. Electric Shop. 20-ton floating derrick, 2 electric welding barges.	Steel ships up to 12,000 tons
Henderson Shipbuilding Company, Inc., Mobile.....	3,000			Machine Shop. Boiler Shop. Blacksmith Shop, Foundry, Pattern Shop, Woodworking Mill, Electric and Acetylene Welding and Cutting Plant.	General repairs steel and wood ships.
Kelly Dry Dock & Shipbuilding Company, Mobile.....	2,000			Machine Shop, Acetylene and Electric Plant.	General repairs steel and wood ships.
Murnan Shipbuilding Corporation, Mobile.	800			Blacksmith Shop.	General repairs steel and wood ships.
California					
C. L. Arques, San Francisco.....	1,200 600				General repairs dredges, barges, lighters.
Banning Shipyard, San Pedro.....	250				General repair work.
Barnes & Tibbitts Shipbuilding & Dry Dock Company, Alameda.....	4,000 2,500				General repairs.
Bethlehem Shipbuilding Corp., Ltd., Union Plant, San Francisco.....	Two to 4,000	Three to 10,000	1,096' x 120' x 40' water O. S. 750' x 103' x 28' water O. S.	Plate and Angle Shop, Planing Mill, Boiler Shop, Bolt Shop, Machine Shop, Brass Foundry, Iron Foundry, Pattern Shop, Sheet Metal Shop, Galvanizing Shop.	Steel ships.
Bowes & Andrews, San Francisco.....					Wood ships.
Cookson & Callahan, San Pedro.....					Wood ships.
Crowley Launch & Tugboat Company, East Oakland.....	600 300				Tugs and barges.
Fellows & Stewart, Inc., Wilmington.....	600 300 75				Wood ships.
Hanlon Dry Dock & Shipbuilding Company, Oakland.....	5,000			Equipment Repair Shop, Plate Shop, Machine Shop, Blacksmith Shop.	Steel ships.
Long Beach Shipbuilding Company, Long Beach.....		3,500		Machine Shop, Foundry, Coppersmith and Pipe Shop, Pattern Shop, Mold Loft, Plate Shop, Smith Shop, Joiner Shop.	Steel ships.
Los Angeles Shipbuilding and Dry Dock Company, San Pedro.....		12,000		Blacksmith Shop, Sheet Metal Shop, Paint Shop, Welding Shop, Planing Mill, Pattern Shop.	Steel ships.
Moore Shipbuilding Company, Oakland....	7,000 7,000 6,000	20,000		Plate, Shop, Machine Shop, Blacksmith Shop, Mill, Angle Shop, Boiler Shop.	Steel ships.
Rolph Shipbuilding Company, Rolph.....				Boat Shop, Mold Loft, Paint Shop, Blacksmith Shop.	Wood ships.
San Diego Marine Construction Company, San Diego.....	200 200 200				Boats to 150 feet.
Stone & Son, Oakland.....					Wood ships.
Terminal Ways & Machinery Company, Long Beach.....					Wood ships.
Twigg & Sons, San Francisco.....	90				Yachts and barges.
Union Construction Company, Oakland....				Carpenter Shop, Pipe Shop, Machine Shop, Foundry, Plate Shop.	Steel ships.

TABLE I.—SHIP REPAIR PLANTS OF THE UNITED STATES.—Continued.

REPAIR PLANT AND LOCATION.	MARINE RAILWAYS. CAPACITY IN TONS.	FLOATING DRY DOCKS. CAPACITY IN TONS.	GRAVING DOCKS. DIMENSIONS	SHOPS.	SPECIALIZE IN REPAIRS TO
Connecticut Connecticut Ship & Construction Company, New Haven.....	350				Tugs and barges.
Dauntless Shipyard, Inc., Essex.....	M. R. 125 feet long				Wood to 100 feet.
Miller Yacht Yard, South Norwalk.....	40 40 40 40 40			Machine Shop.	General repairs, yachts.
Ship Construction & Trading Company, Stonington.....				Paint Shop, Saw Mill, Blacksmith Shop, Pipe Shop, Planing Mill, Mold Loft, Joiner Shop.	Wood ships.
Thames Tow Boat Company, New London.	3,000 1,000				General repairs tugs and barges.
Delaware American Car & Foundry Company, Wil- mington.....	1,000 600				General repairs wood ships.
Bethlehem Shipbuilding Corp., Ltd., Harlan Plant, Wilmington.....			330' x 40' x 12' water O. S.	Completely Equipped Plant.	Steel ships.
Delaware Shipbuilding Company, Seaford..	One M. R.				Wood ships.
Florida Avery & Roberta Marine Ways Company, Inc., St. Petersburg.....	400 400				Wood ships.
The Bruce Dry Dock Company, Pensacola.		5,000 1,200			Steel and wood ships.
Gibbs Gas Engine Company, South Jack- sonville.....		1,000			Steel ships to 250 feet.
McCoy Bros., Holly Hill.....	175				Yachts.
Merrill-Stevens Shipbuilding Corp., Jackson- ville.....	750	6,500 4,500		Fabricating Shop and Mold Loft, Carpen- ter Shop, Joiner Shop, Paint Shop, Tin and Coppersmith Shop, Plumbing Shop, Rigging Shop, Electric Shop, Machine Shop.	Steel ships.
Tampa Dock Company, Tampa.....	2,500			Machine Shop, Woodworking Department	Steel ships.
Tampa Steam Ways Company, Tampa....	800 500				Wood ships.
Warren Fish Company, Pensacola.....	300				General repairs.
Wm. Curry Sons Company, Key West.....	1,000 500				General repairs.
Georgia Brunswick Marine Construction Corp., Brunswick.....	900				General repairs.
Southland S. S. Company, Savannah.....				Machine Shop, Mold Loft, Smith Shop, Paint Shop, Pipe Fitting Shop, Joiner Shop.	Steel and wood ships.
U. S. Maritime Corp., Brunswick.....				Machine Shop, Steel Shop, Wood Working Mill, Fabricating Shop.	General repairs.
Wilkinson Machine Company, Savannah..					General repairs.
Illinois American Shipbuilding Company, Chicago.			570' x 72' x 16' water O. S. 727' x 90' x 16' water O. S.	Joiner Shop, Paint Shop, Mold Loft, Tin Shop, Pipe Shop, Blacksmith Shop, Ma- chine Shop, Pattern Shop.	Steel ships.
Kraft Shipyard & Dry Dock Company, Chicago.....					General Repairs.
Lake Shipbuilding Company, Chicago.....	M. R.				Steel and wood ships.
Indiana Howard Shipyard & Docks Company, Jeffer- sonville.....	M. R.				River craft.
Louisiana Jahncke Dry Dock & Ship Repair Company, Inc., New Orleans.....		10,000 8,000 6,000			General repairs.
Johnson Iron Works, Dry Dock & Ship- building Company, Inc., New Orleans....		5,000 2,000 250		Furnace Shop, Forging Shop, Machine Shop, Plate and Angle Shop.	General repairs.
Stern Foundry & Machinery Company, New Orleans.....					General repairs.
Maine Camden Yacht Building & Railway Com- pany, Camden.....	700 300				General repairs.
Cumberland Shipbuilding Company, South Portland.....		2,500		Mold Loft, Carpenter Shop, Heavy Tim- ber Mill, Blacksmith Shop, Saw Mill.	General repairs.
Job Shipyard Corp., Machias.....					Wood ships.
Noues Machine Company, South Portland.					Machinery repairs.
Percy & Small, Inc., Bath.....					Wood ships.

TABLE I.—SHIP REPAIR PLANTS OF THE UNITED STATES.—Continued.

REPAIR PLANT AND LOCATION.	MARINE RAILWAYS. CAPACITY IN TONS.	FLOATING DRY DOCKS. CAPACITY IN TONS.	GRAVING DOCKS. DIMENSIONS	SHOPS.	SPECIALIZE IN REPAIRS TO
Maryland					
Baltimore Dry Docks & Shipbuilding Company, Baltimore.....	1,500 800		600' x 62' x 18' water O. S. 437' x 52' x 16' water O. S.	3 Plants, Completely Equipped.	General repairs.
Booz Bros., Baltimore.....	1,800				Wood ships.
Cambridge Manufacturing Company, Cambridge.....	150				Wood ships.
Chance Marine Construction Company, Annapolis.....	250 20			Planer Shed, Carpenter Shop, Saw Shed Machine Shop, Forge Shop and Mold Loft.	Yachts, tugs, barges.
Crisfield Marine Railways, Crisfield.....	M. R. 150 Feet				General repairs.
Davis & Son, Inc., Solomons.....	300				Wood tugs and barges.
Globe Shipbuilding & Dry Dock Company, Baltimore.....		500' x 100'			General repairs.
McIntire & Henderson, Baltimore.....				Machine Shop and Boiler Shop.	Machinery repairs.
Bethlehem Shipbuilding Corp., Ltd., Sparrows Point Plant, Sparrows Point.....		20,000 6,000		Completely Equipped Plant.	Steel ships.
Smith & Williams Company, Salisbury....	250			Planer Shed, Tin and Paint Shop, Machine Shop, Woodworking Shop.	Wood ships to 250 feet.
Union Shipbuilding Company, Baltimore..	4,000				Steel ships.
Massachusetts					
Atlantic Works, Boston.....	2,000 1,000 500				Steel ships.
Bertelsen & Petersen Engineering Company, Boston.....					General repairs.
Bethlehem Shipbuilding Corporation, Ltd., Fore River Plant, Quincy.....		10,000		Completely Equipped Plant.	Steel ships.
R. Bigelow, Monument Beach.....	30 30 30				Yachts to 100 feet.
S. W. K. Brooks, Boston.....					Wood ships.
Brown Boat Yard, Taunton.....	100				Yachts.
Crowninshield Shipbuilding Company, South Somerset.....	5,000 1,000 25			Machine Shop, Blacksmith Shop, Saw Mill, Carpenter Shop.	General repairs steel and wood ships.
Richard T. Green Company, Chelsea.....	2,000 1,600 250				General repairs steel and wood ships.
New Bedford Dry Dock Company, Fairhaven.....	2,500 1,000				General repairs.
Rocky Neck Marine Railway Company, Gloucester.....	250				General repairs.
Simpson's Patent Dry Dock Company, East Boston.....			450' x 81' x 16' water O. S. 255' x 68' x 15' water O. S. 150' x 44' x 11' water O. S.		General repairs.
Winnisimmet Shipyard, Inc., Chelsea.....	3,000				General repairs.
Geo. Lawley & Son Corp., Boston.....	500 60 35				Yachts.
Michigan					
American Shipbuilding Company, Detroit..			367½' x 74' x 16½' water O. S.	Forge Shop, Rivet Shop, Shape Shop, Plate Shop, Assembling Shop, Carpenter Shop, Mold Loft, Structural Shop.	General repairs.
Dachet-Carter Shipbuilding Company, Benton Harbor.....		One Dock 125' x 24'		Mold Loft, Woodworking Shop, Machine Shop, Joiner Shop, Blacksmith Shop, Saw Mill.	Wood ships to 200 feet.
Great Lakes Engineering Works, River Rouge.....		8,000 1,700		Machine Shop, Iron Foundry, Carpenter Shop, Pattern Shop, Blacksmith Shop, Erecting Shop.	Steel ships.
Heckler Bros., Sault Ste. Marie.....	1,000				General repairs.
Lanzell Shipyard, St. Clair.....					General repairs.
S. C. McLouth, Marine City.....					General repairs.
Port Huron Shipyard, Inc., Port Huron....			350' x 50' x 16' water O. S.	Plate Shop, Angle Shop, Blacksmith Shop.	General repairs.
Minnesota					
Marine Iron & Shipbuilding Co., Duluth...		350			General repairs.
New Jersey					
American Shipyard Company, Camden....	2,000				General repairs.
Bethlehem Shipbuilding Corp., Ltd., Moore Plant, Elizabeth.....				Machine Shop, Forge Shop, Foundry, Plate and Angle Shop, Carpenter and Joiner Shop, Paint Shop, Pattern Shop.	Steel ships.

TABLE I.—SHIP REPAIR PLANTS OF THE UNITED STATES.—Continued.

REPAIR PLANT AND LOCATION.	MARINE RAILWAYS. CAPACITY IN TONS.	FLOATING DRY DOCKS. CAPACITY IN TONS.	GRAVING DOCKS. DIMENSIONS	SHOPS.	SPECIALIZE IN REPAIRS TO
Delaware Shipbuilding & Repair Company, Camden.....					General repairs.
The Elco Works, Bayonne.....	One M. R.				Yachts.
Federal Shipbuilding Company, Kearney..		12,000		Mold Loft, Furnace Shop, Plate Shop, Joiner Shop, Machine Shop, Sheet Metal Shop, Forge Shop, Foundry, Rigging Loft, Paint Shop.	Steel Ships.
W. & A. Fletcher Company, Hoboken.....		8,500			Steel ships.
John H. Mathis Company, Camden.....	1,000			Machine Shop, Boiler Shop, Electric and Acetylene Welding Plant.	Tugs, Barges and Yachts.
The Lord Dry Dock Company, Weehawken.	10,000	4,000 1,200 1,200 1,000 1,000			General repairs.
Morgan Engineering Company, Jersey City.					General repairs.
New Jersey Dry Dock & Transportation Company, Elizabethport.....	2,500 540			Saw and Planing Mill, Joiner Shop, Pipe Shop, Plate and Angle Shop, Mold Loft, Paint Shop, Machine Shop.	General repairs.
Perth Amboy Dry Dock Company, Perth Amboy.....		10,000 2,500 2,000 1,000 500		Machine Shop, Boiler Shop, Blacksmith Shop. Utility boat equipped with tow- ing, welding and air compressor appara- tus.	General repairs.
John Swenson, Jersey City.....		1,000 400			Wood ships.
Tietjen & Lang Dry Dock Company (Todd Shipyards Corp.), Hoboken.....		7,000 4,000 1,500 1,200 800 600 600 400 300		Completely Equipped Plant.	General repairs.
Union Dry Dock & Repair Company, Wee- kawken.....		2,000 1,000 800 500			General repairs.
Vulcan Iron Works, Inc., Jersey City.....		Six docks ranging from 1,200 to 6,000 tons		Joiner Shop, Saw Mill, Pattern Shop, Blacksmith Shop, Electrical Shop, Pipe Shop, Plumbing Shop, Floating Repair Shop and Electric Welder	General repairs.
New York The American Shipbuilding Company, Buf- falo.....			470' x 62' x 13½' water O. S. 630' x 81' x 14½' wa- ter O. S. 401' x 47' x 14½' wa- ter O. S.	Carpenter Shop, Electric Shop, Rigging Shop, Paint Shop, Punch Shop, Saw Mill Machine Shop, Blacksmith Shop, Pipe Shop, Tin Shop, Brass Shop.	General repairs.
Brewer Dry Dock Company, Staten Island.		6,000 1,200 800		Woodworking Mill, Boiler Shop, Black- smith Shop, Machine Shop.	General repairs.
Buffalo Marine Construction Company, Buffalo.....					General repairs.
Ira Bushey & Sons, Inc., Brooklyn.....		7,500 1,500			General repairs.
Clinton Dry Dock, Inc. (Todd Shipyards Corp.), Brooklyn.....		9,000		Completely Equipped Plant.	General repairs.
Consolidated Shipbuilding Corp., New York	300 150			Carpenter and Joiner Shop, Mold Loft, Machine Shop, Blacksmith Shop, Saw Shed.	Yachts, tugs and barges to 200 feet.
T. A. Crane Sons Company, Brooklyn.....					General repairs.
C. M. Englis, Inc., Brooklyn.....					Wood ships.
Fyle's Shipyard, Glenwood, L. I.....	300 300 300				Yachts.
Glen Cove Shipyard, Glen Cove, L. I.....	1,000				Yachts, tugs and barges.
Gokey & Company, Brooklyn.....	3,000 1,200 800				General repairs.
Greenport Basin & Construction Company, Greenport, L. I.....	1,200 800 200 30				General repairs.
Greenport Ship Company, Greenport, L. I..	500 200 75				Yachts.
Haff's Marine Railways, Babylon, L. I....	100 100 100				Boats to 100 feet.
Hiltebrant Dry Dock Company, South Rondout.....		1,200 800			Tugs and barges.

TABLE I.—SHIP REPAIR PLANTS OF THE UNITED STATES.—Continued.

REPAIR PLANT AND LOCATION.	MARINE RAILWAYS. CAPACITY IN TONS.	FLOATING DRY DOCKS. CAPACITY IN TONS.	GRAVING DOCKS. DIMENSIONS	SHOPS.	SPECIALIZE IN REPAIRS TO
Hutchinson Bros., Alexandria Bay.....	50				Yachts to 125 feet.
Robert Jacob, City Island.....	1,100				Yachts, tugs and barges.
Johnson Shipyard Corp., Mariners Harbor, S. I.....		6,000 2,000		Mold Loft, Joiner Shop, Blacksmith Shop, Saw Shed, Planer Shed, Paint Shed.	General repairs.
Kyle & Purdy, Inc., City Island.....	500 500 100			Saw Mill, Paint Shop, Joiner Shop, Mold Loft, Furnace and Punch Shop, Ma- chine Shop, Copper and Sheet Metal Shop, Forge Shop.	Yachts and tugs.
Kingston Shipbuilding Corp., Kingston....	1,500				Wood ships.
Liberty Dry Dock & Repair Company, Brooklyn.....		4,000 2,000 1,000			Tugs and barges.
Frank McWilliams, Inc., Staten Island....	2,000 1,100 1,000 600				Tugs and barges.
Morse Dry Dock & Repair Company, Brook- lyn.....		30,000 15,000		Completely Equipped Plant. Floating equipment consists of 5 tugboats, 3 lighters, 2 welding barges, 2 launches.	General repairs.
National Dry Dock & Repair Company, West New Brighton.....	2,500 1,500 1,000				General repairs.
H. B. Nevins, Inc., City Island.....	100 75 50				Yachts.
New Baltimore Shipbuilding & Repair Com- pany, New Baltimore.....	400				Wood ships.
New York Harbor Dry Dock Corp., Port Jefferson, L. I.....	1,500 500				Steel and wood ships to 5,000 tons.
New York Harbor Dry Dock Corp., Rose- bank, S. I.....		12,000 10,000			General repairs.
New York Yacht, Launch & Engine Com- pany, Morris Heights.....	60 40				Yachts.
Julius Peterson, Nyack.....	Six to 100' long				Yachts to 100 feet.
Ramberg Dry Dock & Repair Company, Brooklyn.....					General repairs.
Robins Dry Dock & Repair Company, (Todd Shipyards Corp.), Brooklyn.....		21,000 7,500 6,000	510' x 100' x 18' water O. S. 620' x 85' x 23' water O. S.	Completely Equipped Plant.	General repairs.
Rochester Boat Works, Inc., Rochester....	50				Wood yachts.
St. Lawrence Marine Railway Company, Ogdensburg.....	3,000				General repairs.
James Shewan & Sons, Inc., Brooklyn.....		12,000 7,000 6,250 3,500 2,500 1,500 1,000 1,000 700 500		Boiler Shop, Machine Shop, Power Plant, Electric and Air Compressor Plant, Pipe Fitting Shop, Coppersmith, Tin Smith and Plumbing Shop, Electrical Shop, Blacksmith Shop, Saw Mill, Joiner Shop, Carpenter Shop and Pattern Shop. 4 Ocean-going tugs, 4 steam launches, 4 welding barges, 2 air compressor barges.	General repairs.
Sound Machine Shop, Inc., Mamaroneck...	125				Yachts and tugs to 75 ft.
Standard Shipbuilding Corp., Shooters Is- land.....	3,500			Plate and Angle Shop, Machine Shop, Blacksmith Shop, Boiler Shop, Pipe Shop, Pattern Shop, Joiner Shop, Elec- trical Shop, Air Compressor Shop, Mold Loft.	General repairs.
Staten Island Shipbuilding Company, Staten Island.....		10,000 3,500 800 800 400 400		Machine Shop, Boiler Shop, Saw Mill, Car- penter Shop, Mold Loft, Plate Shop, Furnace Shed, Iron Foundry and Brass Foundry.	General repairs.
Tank Shipbuilding Corp., Newburgh.....	500				Tugs and barges.
Tebo Yacht Basin Company (Todd Ship- yards Corp.), Brooklyn.....		2 docks to 10,000		Completely Equipped Plant.	General repairs.
Tregarthen & Sons Company, New York...		3,000 2,000 1,000			General repairs.
North Carolina Elizabeth City Shipyard Company, Eliza- beth City.....	210 feet 110 feet				General repairs.
Geo. A. Fuller Company, Wilmington.....					Steel ships.
Hamme Marine Railway Company, Wil- mington.....	1,500 100				Wood ships.
New Bern Marine Railway, New Bern.....	100' x 25'				River craft.
Willis Marine Railways, Morehead City...	200				Wood ships.

TABLE I.—SHIP REPAIR PLANTS OF THE UNITED STATES.—Continued.

REPAIR PLANT AND LOCATION.	MARINE RAILWAYS. CAPACITY IN TONS.	FLOATING DRY DOCKS. CAPACITY IN TONS.	GRAVING DOCKS. DIMENSIONS.	SHOPS.	SPECIALIZE IN REPAIRS TO
Wilmington Marine Railway Company, Wilmington.....	1,000				General repairs.
Ohio American Shipbuilding Company, Cleveland.....			547' x 65' x 17' water O. S. 450' x 50' x 16' water O. S. 360' x 50' x 12 3/4' water O. S.	Pattern Shop, Machine Shop, Foundry, Electric Shop, Tin Shop, Coppersmith Shop, Blacksmith Shop, Angle Iron Shop, Plate Shed, Pipe Shop, Woodworking Shop, Rivet Shop, Paint Shop, Boiler Shop.	General repairs.
American Shipbuilding Company, Lorain..			586' x 66' x 14 1/2' water O. S. 736' x 80' x 14 1/2' water O. S.	Electric Shop, Saw Mill, Pipe Shop, Joiner Shop, Punch Shop, Rivet Shop, Forge Shop, Sheet Metal Shop, Copper Shop, Angle Furnace, Machine Shop, Plumbing Shop, Boiler Shop, Paint Shop.	General repairs.
Great Lakes Engineering Works, Ashtabula			600' x 72' x 16' water O. S.	Sheet Metal Shop, Angle Furnace, Plate Furnace, Joiner Shop, Paint Shop, Blacksmith Shop, Machine Shop, Saw Mill.	Steel vessels
Lake Erie Dry Dock & Mill Company, Sandusky.....	400				General repairs tugs and barges.
James Sears, Toledo.....	300				General repairs.
Toledo Shipbuilding Company, Toledo.....			690' x 96' x 14 1/2' water O. S. 563' x 80' x 13' water O. S.	Boiler Shop, Joiner Shop, Lumber Shop, Paint Shop, Machine Shop, Foundry, Pattern Shop, Blacksmith Shop.	General repairs.
Oregon Portland Shipbuilding Company, Portland.	1,400 250				General repairs.
Pennsylvania Wm. Cramp & Sons Ship & Engine Building Company.....	3,000 1,000		433' x 69'	Completely Equipped Plant.	Steel ships.
Dravoburg Dock & Construction Company, Dravoburg.....					Wood ships.
Elizabeth Marine Ways, Pittsburgh.....	1 M. R.	3 docks			River craft.
Philadelphia Ship Repair Company, Philadelphia.....		3,500 1,200			General repairs.
Sun Shipbuilding Company, Chester.....		1 dock 550' long		Boiler Shop, Outfitting Shop, Paint Shop, Carpenter Shop, Assembling Shop, Fabricating Shop, Furnace and Angle Shop, Smith Shop, Machine Shop.	Steel ships.
Rhode Island Lord Dry Dock Corp., Providence.....	3,500				General repairs.
Narragansett Shipbuilding Company, Tiverton.....	800				General repairs.
F. S. Nock, East Greenwich.....	250				Yachts.
South Carolina Charleston Dry Dock & Machine Company, Charleston.....	1,700 500	8,500		Boiler Shop, Machine Shop, Pattern Loft, Forge Shop, Foundry, Woodworking Shed, Coppersmith Shop and Repair Barge with Electric Welding Outfit, Air Compressor, etc.	General repairs.
Tennessee Nashville Bridge Company, Nashville.....	2,500			Plate Shop, Forge Shop, Machine Shop, Assembling Shop.	Steel barges.
Texas Beaumont Shipbuilding & Dry Dock Company, Beaumont.....	2,600			Paint Shop, Mold Loft, Blacksmith Shop, Copper Shop, Machine Shop.	General repairs tugs and barges.
The Direct Navigation Company, Houston.	250' x 50'				General repairs, ships to 600 tons.
Galveston Dry Dock & Construction Company, Galveston.....	1,200	10,000		Machine Shop, Blacksmith Shop, Plate Shop, Woodworking Shop, Air Compressor, Electric Welding Outfit.	General repairs.
Heldenfels Bros. Shipyards, Rockport.....	400			Mold Loft, Saw Mill, Blacksmith Shop.	Tugs and barges.
Seaboard Transportation & Shipping Company, Channel Dyke.....					General repairs.
Virginia Colonna Marine Railway Corp., Norfolk..	4,500 1,500 750 500				General repairs.
Mathews Marine Railway, Williams Wharf	100				Wood vessels to 100 tons
Newport News Shipbuilding & Dry Dock Company, Newport News.....			738' x 84' x 30' water O. S. 542' x 50' x 25' water O. S. 509' x 79' x 24' water O. S.	Completely Equipped Plant.	General repairs.
Norfolk Shipbuilding & Dry Dock Corp., Norfolk.....					General repairs.
Norfolk Marine Railway Company, Norfolk	1,000 750				General repairs.
Old Dominion Marine Railway Corp., Norfolk.....	2,000 1,000				General repairs.

(Table continued on page 94.)

Passenger Steamship Mount Clay

(Concluded from page 22.)

tain's dining saloon, which will be used by the main officers of the ship. The wireless house and the staterooms for the wireless operators are also on this deck, being abaft the after-boiler hatch.

On the upper deck forward will be found the upper dining saloon, with a capacity of 140 persons. This room is finished in paneled oak. On the after end of this deck will be found the women's sitting room, which is also done in paneled oak and is finished with built-in upholstered seats and portable furniture.

There is an emergency light set, situated in a steel house on this deck, which consists of a 17-kilowatt gasoline-driven generator. This is connected to the emergency light set, as well as the wireless apparatus, no batteries being used.

On the main deck forward will be found the crew's quarters, hospital, etc. The lower dining room with a seating capacity of 334 persons is finished in paneled oak on the sides and paneled overhead.

On the after-well deck will be found a barroom on the starboard side and a dispensary on the port side. These are fitted in the most up-to-date manner. The passengers on this deck are all accommodated in staterooms.

On the second deck will be found the berthing space for the steerage passengers in the large holds. These berths are all so arranged that cargo may be carried in this space if desired.

The Rich system of fire extinguishing and smoke detection has been installed, as well as a sprinkling system in various departments.

LIFE SAVING EQUIPMENT

To provide lifeboat capacity for such a large number of persons carried required considerable planning, as there is such a small space available for this equipment. It was finally decided to install seven sets of Welin davits on each side of the vessel, these davits taking care of the following boats:

One 24-foot standard motor Welin lifeboat; one 24-person standard Welin lifeboat; two 26-foot standard Welin lifeboats; ten 28-foot standard Welin lifeboats; fourteen 28-foot Broady 2-a lifeboats.

These provide for 1,613 persons. In addition to the above there are also fitted two, 25 persons each, cylindrical life rafts, taking care of a total of 1,663 persons, which includes 1,452 passengers and 211 crew.

The vessel has a draft of 27 feet 8½ inches and a displacement of 15,200 tons. A double bottom ballast will carry 988 tons of salt water. The reserve feed tanks in double bottom will carry 234 tons of fresh water. The ship's fresh water tanks have a capacity of 285 tons of fresh water. The coal bunker capacity is 3,701 tons, at 42 cubic feet per ton.

MACHINERY

The vessel is driven by twin screws, each engine being of the following dimensions: 24.8 inches by 36.31 inches by 51.67 inches by 74.8 inches by 55.1 inches stroke. Each engine develops 4,000 indicated horsepower at 86 revolutions.

BOILERS

There are two double ended boilers and three single ended of the Scotch type fitted with Morison furnaces. The double ended boilers are 16 feet 3 inches, outside diameter, 19 feet in length.

The two single ended boilers are 16 feet 3 inches outside diameter and 11 feet 6 inches long, and one single ended boiler 15 feet 3 inches outside diameter and 11 feet 6 inches long, which is used as a donkey boiler.

There are 27 furnaces. The grate surface for the single

ended boilers is 72.32 square feet and 146 square feet for each of the double ended boilers. These boilers are supplied with the Howden forced draft system and worked at a pressure of 213 pounds.

PROPELLER

The propeller is of the built-up type, cast iron hub, and four bronze blades. The following are the particulars of this propeller:

Diameter, 17 feet 9 inches; pitch, 21 feet; projector area, 71.04 square feet; developed area, 90.68 square feet; disk area, 247.45 square feet; pitch ratio, 1.18; projected area divided by disk area, .22; developed area divided by disk area, .7.

Two spare blades are carried on board.

CONDENSER

The main condenser is of the surface type.

Dynamos are of a German make, direct current, compound engines with a rating of 110 volts and 100 kilowatts.

The ship is equipped with 11 winches: three 7¾ inches by 11⅞ inches, six 8 inches by 13⅞ inches, two 8½ inches by 7⅞ inches, the latter two being used as boat winches on the boat deck.

The windlass has 10-inch cylinders and 14-inch stroke.

VENTILATION

The vessel throughout the steerage quarters is fitted with a forced ventilation system with a number of fans directly connected to ducts that exhaust to the atmosphere.

PUMPS

Main Feed No. 1.—Weir's simplex, 14 9/16 inches by 24 inches by 10 5/16 inches.

Main Feed No. 2.—Weir's simplex, 14 9/16 inches by 24 inches by 10 5/16 inches.

Auxiliary Feed.—Vulcan duplex, 14 9/16 inches by 12 inches by 9¼ inches.

General Service.—Vulcan duplex, 14½ inches by 12 inches by 9 3/16 inches.

Line Feed.—4½ inches by 24 inches.

Evaporator Feed.—Navy Yard simplex.

Fresh Water No. 1 and No. 2.—Blake duplex, 4.5 inches by 3 inches by 4 inches.

Main Circulators.—Vulcan centrifugal, 11 3/16 inches by 9¾ inches.

Distiller Circulator.—Simplex.

Ice Machine.—6¾ inches by 5 inches by 6 inches.

Brine.—Worthington duplex, 6 inches by 7 inches by 6 inches.

Bilge.—Vulcan duplex, 8 inches by 9 inches by 10½ inches.

Line Bilge.—6¾ inches by 24 inches.

Sanitary and Ballast.—Wheeler duplex, 7½ inches by 10¼ inches by 10 inches.

Stand-by Sanitary.—Worthington duplex, 6 inches by 4 inches by 6 inches.

Fire and Bilge.—Worthington duplex, 7½ inches by 11 inches by 7 1/16 inches.

Ind. Air Pump.—Blake duplex, 8 inches by 12 inches by 16 inches.

Auxiliary Circulator.—Vulcan centrifugal, 6 3/32 inches by 6 inches.

The Atlantic Coast Shipbuilders Association reports that there remain under construction in five different shipyards on the Delaware River 26 vessels for the United States Shipping Board. All of these yards are expected to complete their schedules by March 1, except the New York Shipbuilding Corporation, which has several combination passenger and freight ships that will not all be delivered before September 1.



General View of First National Marine Exposition

Second New York Marine Exposition

National Marine League Completes Plans for Third of the Series of Shipbuilding and Shipping Expositions

OPENING shortly before the inauguration of the new presidential administration, pledged to the support and upbuilding of the American merchant marine, the coming National Marine Exposition to be held at the Grand Central Palace, New York City, January 24-29, will illustrate and further the developments in maritime affairs which will end in the stability of the American merchant marine and success in its fight for a place in the supremacy of the seas. It will be the third marine show held in this country and will combine with the interest of the first and second a new force and optimism. The outstanding feature of the first New York show was the arousing of general public interest and the bringing of a great mass of American voters to a state of shipmindedness which will eventually take concrete expression in a voting voice for the betterment and protection of the American merchant marine. The second show, held in Chicago, a thousand miles from tidewater, brought home to the people of the middle west their close and immediate connection with America's carrying trade, and the practical advan-

tages to them which would follow the opening up of this region.

The Chicago show was an invasion of a region which has never been considered sea-minded by the maritime interests of the east, and it is interesting to see that in the coming exposition the middle west is returning the compliment. Many firms which operate chiefly on the Great Lakes will install displays to demonstrate that practice proven on the Lakes can be effectively applied to the problems of the tidewater, particularly, of course, in regard to freight handling at terminals. This interchanging of ideas is one of the most important features of the expositions, for, above all, they serve as a point of contact, a meeting place of the manufacturer and the shipper, the shipbuilder and the ship operator, and the marine industry and the public, and as these groups get to know each what the other is doing a basis will be formed for partnerships of mutual benefit.

The main floor of the Grand Central Palace will be occupied largely by shipbuilders and American steamship lines,

the manufacturers of engines and life saving equipment. Walking about this floor, the visitor will first see how ships are built, the processes being illustrated by machinery in operation wherever size permits; then, a few feet further, he will see how they are equipped with the thousand and one pieces of essential gear, from turbines, steering engines, main engines both Diesel and steam, lifeboats, signalling and control devices, down to such minor but still all important items as piping, valves and cordage. Then a few aisles further on the visitor will see maps, panoramas and models illustrating how the ships are used when they are built and how repaired when damaged by accident.

The mezzanine floor is in some respects a repetition of the first. The features of this floor are specialties and inventions, ranging from submarine signalling devices through engineering features which insure the efficient operation of main and auxiliary power installation down to the latest devices added to galley equipment, sail making and advanced marine publications. Throughout the exposition the exhibitors will make an increased use of operative exhibits and pictures to drive home to visitors exactly what it is they make and how the devices and equipment operate. The maritime trade must sell the idea of overseas trade to the American people, and the exposition is a means of doing so.

The programme to be carried out during the exposition includes the discussion of problems pertaining to inland waterways, as well as to shipbuilders and ship operators.

An innovation at the National Marine Banquet to be at the Hotel Commodore, January 15, will be the transmitting of the dinner addresses by radio to all points within a radius of 300 miles. The dinner will be given in connection with the National Marine Exposition, under the auspices of the National Marine League. Frank C. Munson, one of the trustees of the League, and president of the Munson Steamship Line, will preside at the dinner. P. H. W. Ross, president of the League, Senator Wesley L. Jones of Washington, and Senator W. M. Calder of New York and other prominent men will be among the speakers.

EXHIBITORS AT THE SECOND NEW YORK NATIONAL MARINE EXPOSITION

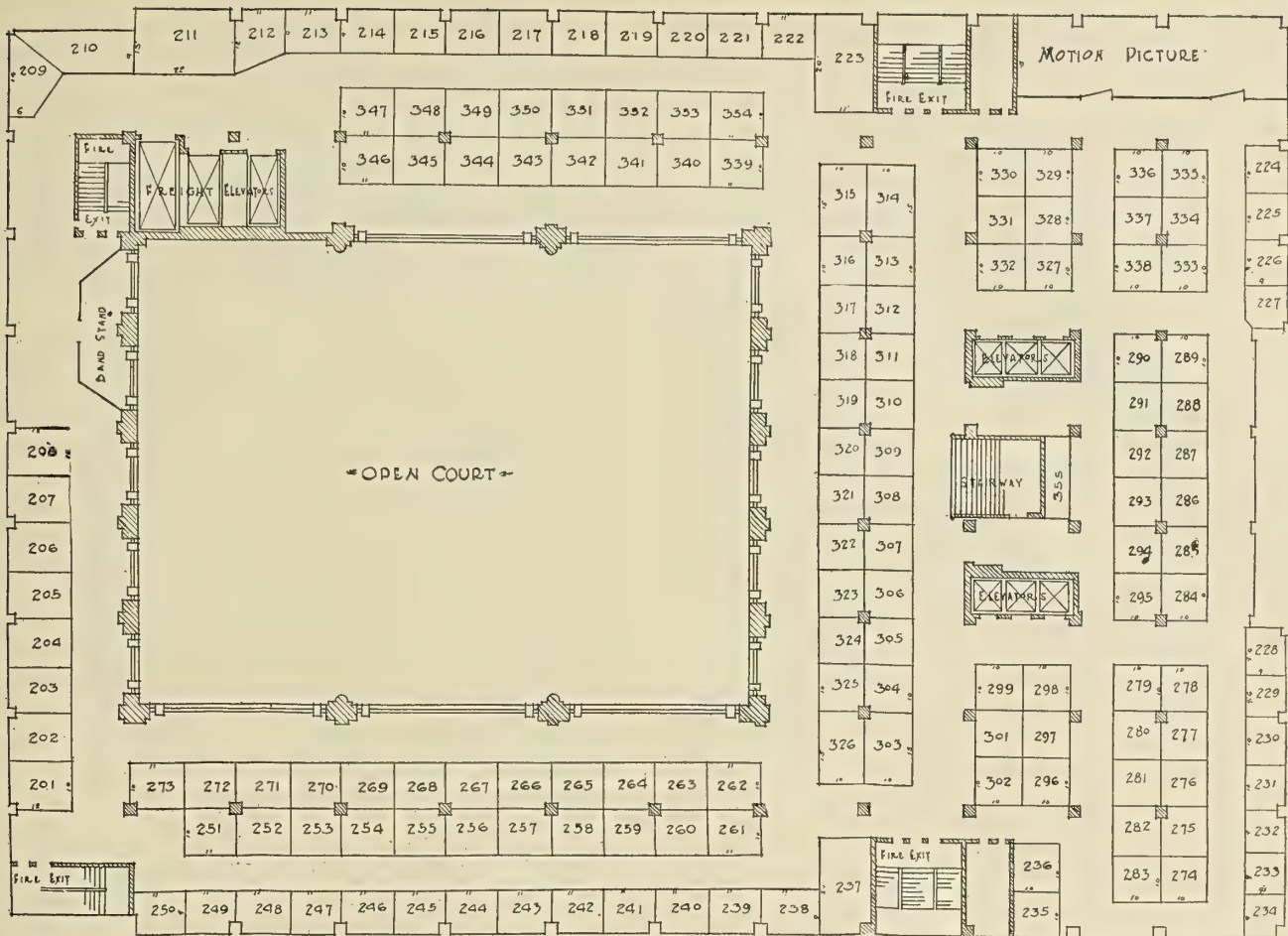
MAIN FLOOR

Exhibitors	Booth Number
American Balsa Company, 50 East 42d St., New York	19, 20, 21
American Car & Foundry Company, St. Louis, Mo.	65
American Engineering Company, Philadelphia, Pa.	17
American Manganese Bronze Company, Philadelphia, Pa.	29
American Manufacturing Company, Brooklyn, N. Y.	43
American Steel Foundries, Chicago, Ill.	36
Asbestolith Manufacturing Company, 1 Madison Ave., New York	38
Babcock & Wilcox Company, 85 Liberty St., New York	10, 11, 12
Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md.	55, 56
Bethlehem Shipbuilding Corporation, Bethlehem, Pa.	78, 79, 89, 90
Boucher, H. E., Manufacturing Company, 150 Lafayette St., New York	33
Brunswick Refrigerating Company, New Brunswick, N. J.	44
Coen Company, San Francisco, Cal.	9
Columbian Rope Company, Auburn, N. Y.	62
Cornell-Emery Company	75, 76
Cory, Chas., & Son, Inc., 290 Hudson St., New York	41, 34, 35
Crane Company, Chicago, Ill.	68, 69
Cutler Hammer Company, Milwaukee, Wis.	70
DeLaval Separator Company, 165 Broadway, New York	93
DeLaval Steam Turbine Company, Trenton, N. J.	91, 92
Electro Manufacturing Company, Brooklyn, N. Y.	71
Fairbanks Morse & Company, Chicago, Ill.	45
Fuller, Geo. A., Company, Wilmington, N. C.	13
General Electric Company, Schenectady, N. Y.	4, 5, 6 and 1/2 of 3
Globe Shipbuilding Company, Baltimore, Md.	14
Gregory, Thos., Galvanizing Works, Brooklyn, N. Y.	28
Guarantee Exterminating Company, 400 Fifth Ave., New York	Part of 1
Hyde Windlass Company, Bath, Me.	16
International Mercantile Marine Company, 9 Broadway, N. Y.	46, 47, 58, 59
Irving Iron Works, Long Island City, N. Y.	74
Locomotive Superheater Company, 30 Church St., New York	48
Luckenbach Steamship Company, 44 Whitehall St., New York	87, 88
Lunkenheimer Company, Cincinnati, Ohio	94
Mallory Industries, Inc.	64
Maritime Engineering & Sales Corporation	37
Metal & Thermit Corporation, 120 Broadway, New York	39
Munson Steamship Line, 82 Beaver St., New York	83, 84, 85, 86
National Hoisting Engine Company, Harrison, N. J.	94
Niles-Bement-Pond Company, 111 Broadway, New York	40
Quasi-Arc Weldtrode Company, Inc., 109 Lafayette St., New York	93
Pacific Mail Steamship Company, San Francisco, Cal.	32
Plymouth Cordage Company, North Plymouth, Mass.	63
Reid, John, & Company, 30 Church St., New York	18

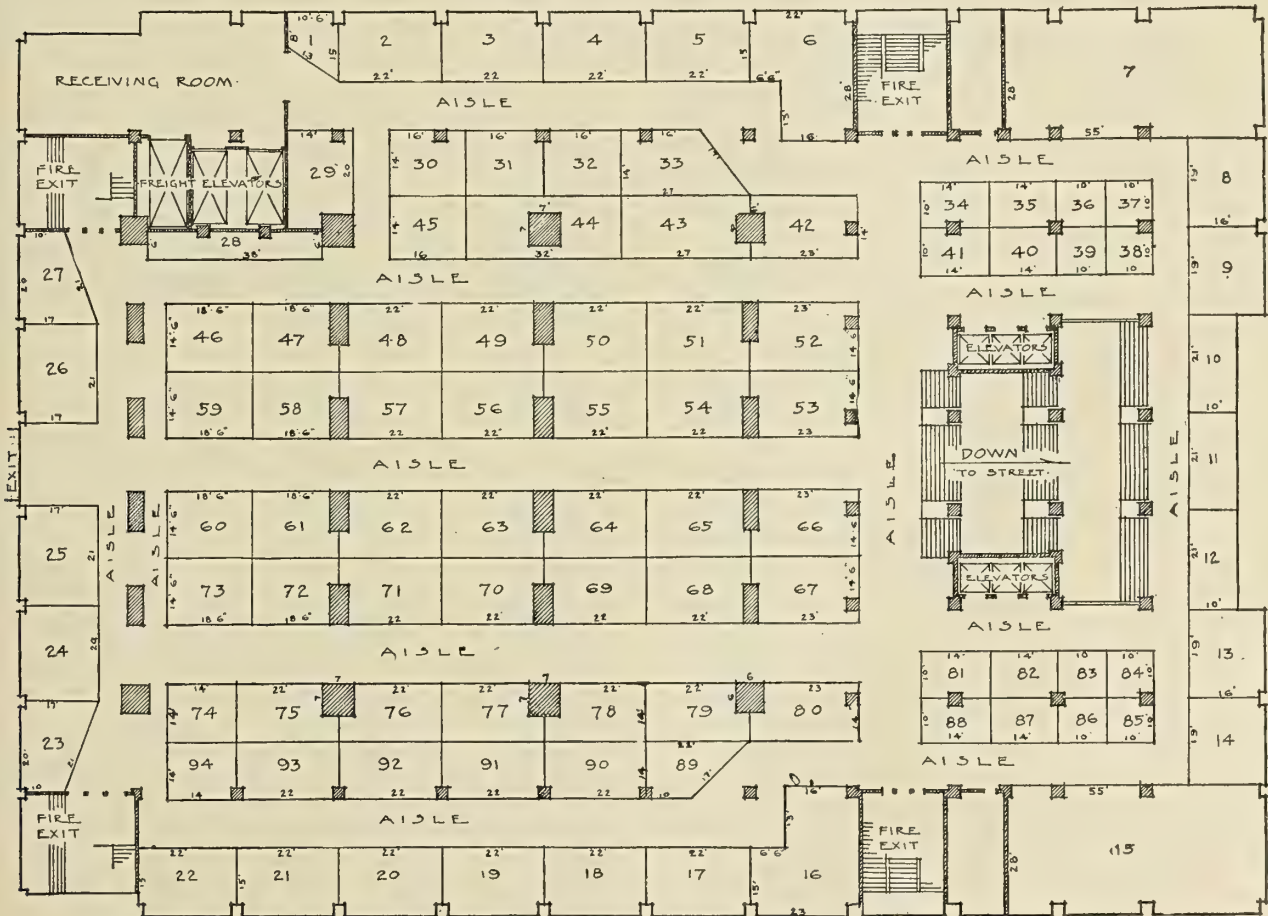
Shepard Electric Crane & Hoist Company, Montour Falls, N. Y.	30, 31
Sperry Gyroscope Company, Brooklyn, N. Y.	8
Stewart Davit & Equipment Corporation, 17 Battery Place, N. Y.	66, 67
Sturtevant, B. F., Company, Boston, Mass.	26
Submarine Boat Corporation, 11 Pine St., New York	60, 61, 72, 73
Sun Shipbuilding Company, Chester, Pa.	Inside of 7
Thorsen, P. S., Company, 81 Coffey St., Brooklyn, N. Y.	77
Todd Shipyards Corporation, 15 Whitehall St., N. Y.	50, 51, 52, 53, 54, 55
United Marine Contracting Corporation	2 and 1/2 of 3
United States Mail Steamship Company, 45 Broadway, New York	22
Wall Rope Company, 48 South St., New York	42
Waterbury Company, 63 Park Row, New York	81, 82
Wheeler, C. H., Manufacturing Company, Philadelphia, Pa.	49
Whitlock Cordage Company, 46 South St., New York	80
Wilson Welder & Metals Company, 2 Rector St., New York	25
Worthington Pump & Machinery Corporation, 115 Broadway, N. Y.	1/2 of 15

MEZZANINE FLOOR

Exhibitors	Booth Number
Aluminum Cooking Utensil Company, 1828 Broadway, New York	270
American Blower Company, Detroit, Mich.	321
American Chain Company, Bridgeport, Conn.	304, 305
Ashton Valve Company, Boston, Mass.	284
Atlas Soot Blower Company, 101 Park Ave., New York	345
Beaver Tile Specialty Company, 44 Cliff St., New York	213
Benjamin Electric Company, 243 West 17th St., New York	322
Benson Electric Company, Superior, Wis.	294
Bowman, M. K. Edson, Company, 65 Dey St., New York	241
Brown, A. Judson, & Company, 30 Church St., New York	298
Buzzini, Walter, Inc., 505 West 21st St., New York	282
C. H. Gillespie & Sons, 149 Broadway, New York	249
Campbell, G. W., 253 Broadway, New York	203
Columbian Bronze Corporation, 50 Church St., New York	342
Consolidated Shipbuilding Corporation, Morris Heights, N. Y.	268
Covel Manufacturing Company	301
Crane Packing Company, Chicago, Ill.	328
Cutting & Washington Radio Corporation, 6 West 48th St., New York	202
Davidson, M. T., & Company, 154 Nassau St., New York	326
Debevoise Company, 968 Grand Ave., Brooklyn, N. Y.	242
Devoo & Reynolds, Inc., 101 Fulton St., New York	214
Donnelly, Wm. T., 17 Battery Place, New York	257
Duparquet, Huot & Moneuse Company, 108 West 22d St., New York	240
Durkee, Chas. D., & Company, 2 South St., New York	250
Durkee Manufacturing Company, Staten Island, N. Y.	292
Edson Manufacturing Company, Boston, Mass.	316
Electric Arc Cutting & Welding Company, Newark, N. J.	201
Fire Detecting Wire Company, 2 West 45th St., New York	272
Foster Marine Boiler Corporation, 111 Broadway, New York	265
Gold Car Heating & Lighting Company, 17 Battery Place, New York	220
Goodrich Transit Company	343
Griscom-Russell Company, West Street Bldg., New York	277, 278, 279, 280
Hamilton & Hansell, 13 Park Row, New York	317
Hamlin-Healy Machine Co., 430 Eleventh Ave., New York	347
Hansen Yorke, Inc., 88 Warren St., New York	306, 307
Hartman, Chas., Company, 981 Dean St., Brooklyn, N. Y.	341
International Nickel Company, 43 Exchange Place, New York	312, 313
Jahncke Dry Dock & Ship Repair Company, New Orleans, La.	350
Kahnweiler's, David, Sons, 260 Front St., New York	269
Kelly Industrial Corporation, 37 Maiden Lane, New York	327
Kinney Manufacturing Company, Boston, Mass.	299
Lord Dry Dock & Construction Company, 105 W. 40th St., N. Y.	296, 297
Mack Engineering & Supply Company, 123 Liberty St., New York	251
Marine Canvas Supply Corporation, Pier 7, North River, New York	273
Marine Works, 3 Coenties Slip, New York	283
Marine Decking & Supply Company, Philadelphia, Pa.	293
Masten, George H., Company, 222 E. 46th St., New York	259
National Life Preserver Company, 11 Broadway, New York	212
Nautical Gazette, 20 Vesey St., New York	340
Nelson Looseleaf Encyclopedia	254
Neptune Association, 15 Park Row, New York	266, 267
Neptune Ship Supply Company, Inc., 73 Front St., New York	329
New Jersey Asbestos Company, 1 Water St., New York	227
New York Engineering Company, 2 Rector St., New York	324, 325
New York Marine News Company, 26 Water St., New York	295
New York Maritime Register, 88 Gold St., New York	204
Ocean Marine Engineers' Beneficial Assn., 15 Whitehall St.	336, 337, 338
Ocean Paint Works, 16 Whitehall St., New York	205
Paige & Jones Chemical Company, 15 E. 40th St., New York	311
Pantasote Company, 11 Broadway, New York	216, 217
Penton Publishing Company, Cleveland, Ohio	353
Pioneer Metallic Packing Company, 150 W. 25th St., New York	321
Pneumecator Company, 15 Park Row, New York	221, 222
Power Specialty Company, 111 Broadway, New York	264
Pyle National Company, The	237
Roberts Safety Boiler Company, 39 Cortlandt Street, New York	294
Roebling's, John A., Sons Company, Trenton, N. J.	323
Row & Davis, Inc., 90 West St., New York	209, 210
Schonberg, I., 122 Flushing Ave., Brooklyn, N. Y.	271
Seoville Manufacturing, Waterbury, Conn.	301
Sea Power	256
Shipping Publishing Company, 32 Broadway, New York	302
SIMMONS-BOARDMAN PUBLISHING COMPANY, Woolworth Bldg., N. Y.	332
Smiths Port Publishing Company, 5 South St., New York	291
South Atlantic Ports Association	181, 219
Starke, Adolph, Estate of	248
Sternau Corporation, 9 East 57th St., New York	352
Sturrock Furnace Bridge Wall Company, 74 Cortlandt St., New York	290
Submarine Signal Corporation	314, 315
Texas Company, 17 Battery Place, New York	223
Thorne Manufacturing Company	330
Thorne Pioneer Company, 3 Atlantic Ave., Brooklyn, N. Y.	303
Tiebout, W. & J., Company, 118 Chamber St., New York	225, 226
Topping Brothers Company, 122 Chambers St., New York	252, 253
Traffic Service Bureau	281
United States Metallic Packing Company, Philadelphia, Pa.	228
Uttmark's Nautical Academy, 8 State St., New York	319
Valentine & Company, 456 4th Ave., New York	238, 239
Van Nostrand, D., Company, 8 Warren St., New York	318
Wager Furnace Bridge Wall Company, Inc., 149 Broadway, N. Y.	339, 354
Wales, Dove, Hermiston Corporation, 17 Battery Place, New York	344
Ward Leonard Electric Company, Mount Vernon, N. Y.	206
Williams, D. T., Valve Company, Cincinnati, Ohio	227
William E. Williams, 62 Front St., New York	308, 309, 310
Wood & Chamberlain	258
Woolsey, C. A., Paint & Color Company, Jersey City, N. J.	245



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Layout of Exhibits on Main Floor of National Marine Exposition

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Naval Policy

THE daily journals give prominence to the proposal to make the American Navy supreme; at the same time come reports that the British Admiralty proposes to defer additions to their fleet till after a study of the results of the recent war, that British statesmen are again proposing the "two nation" standard, that France is considering the construction of a huge submarine fleet and that Japan conditions her naval policy on that of the United States.

The war has left the British Navy supreme, and under the present financial stringency she may well take a look around before going ahead. If the "two nation" standard is held to, it today relates to her friends and allies, the United States and Japan.

Japan has had a phenomenal rise and has been shot forward into prominence by the abject surrender of the German fleet; her own statesmen, however, proclaim that she is not in condition to compete with either of the English speaking peoples. But her problems and her policy are her own and her statesmen have shown wisdom and foresight.

Our naval policy is now recognized to concern the whole nation—those who live on the prairies as well as those on the seaboards. Fortunately there is a general consensus of opinion that we must have a powerful navy and that our ships must be as good as the best; there never has been any question concerning the personnel and there never will be. We are committed to a large building programme; there is no opinion that the programme is excessive whether or not we join the League of Nations or whether there is any League of Nations.

But a race for supremacy between the United States and Great Britain is to be deprecated. Both nations are rich and both are stubborn. Each can well afford all the navy it needs; each can well consider first how much power it needs to ensure against any reasonable probability.

Ocean Liners and Passenger Ships

THERE is a world shortage of combination cargo and passenger vessels of the intermediate type. Shipping companies have been carrying on almost wholly with vessels that they have reconditioned since the armistice. Great Britain has a large number of intermediate liners under construction on the ways of the shipbuilding companies in that country with an indefinite prospect for work of this nature which is limited only by the cost of construction and date of delivery.

The excessive cost of vessels of the *Aquitania* and *Olympic* type, both as to construction and operation, has limited the present building to vessels of about 20,000 tons in size with large cargo carrying capacity and passenger accommodations of a comfortable but plain and non-luxurious character. This situation presents to America the very best inducement to try an active hand in the construction of passenger vessels. Twenty-six combination cargo and passenger vessels have been contracted for by the Shipping Board, some of which have been completed and the remainder are now under construction. The experience gained on these vessels and other passenger ships, together with the reconditioning of German liners, should place the American shipyards in a position to bid intelligently on such work.

Last spring and during the summer it was impossible to secure a passage on most lines unless booked far ahead, and there will be comparatively few new vessels available for next spring. With steel cheaper, labor-saving devices much more extensively used, and standardization of fittings, joiner work, etc., more highly developed, American shipowners and shipyards should get together with a view to securing the constructing of our share of passenger vessels in this country.

Prohibition on American Passenger Lines

THE enforcement of prohibition on American passenger vessels outside of the three mile limit will prove to be a severe handicap which our vessels will have difficulty in overcoming. A liner does a cosmopolitan and international business, and it is no more than right that we should respect those privileges of personal liberty that practically all countries outside of the United States consider proper. If the ocean belonged to the United States it would perhaps be different, but it belongs to one country as much as it does to another. So long as our ships have one or more of their terminals in a wet country the enforcement of prohibition aboard our vessels will not only be a financial loss to the American owners but the cause of numerous and perhaps serious misunderstandings, a condition to be deplored when we are striving to create good-will and better social relations.

If prohibition is put in practice on American vessels it can only be partially enforced on the outgoing voyage because wet countries cannot be expected to prevent people from carrying liquor aboard our vessels in their trunks. This condition of unrestrained drinking in staterooms would undoubtedly be much worse than the well regulated system of controlled distribution that now prevails aboard most ships. It is hardly too much to say that the result of the enforcement of prohibition on our vessels would drive many Amer-

icans as well as aliens to foreign liners, and that a large percentage of those who did travel on our liners would carry their liquor with them or buy it from some bootlegger on board. It is no more possible to enforce prohibition on one vessel when another running between the same terminals is wet than it was to keep one state dry while liquor was being sold by its neighbor.

The Load Line

IT is earnestly hoped that the pending Load Line Bill will be enacted by Congress at the present session. This important measure has already passed the House of Representatives and is awaiting action by the Senate Committee on Commerce. The Secretary of Commerce, under whose jurisdiction the enforcement of the law will come, when passed, has already appointed a committee of experts to draft the necessary regulations under which the various types of vessels will have load lines affixed. This committee is presided over by Admiral D. W. Taylor, Chief Constructor of the Navy, who has to assist him as chairmen of sub-committees Professor G. R. McDermott of Cornell, Professor H. C. Sadler of Michigan and Professor W. F. Durand of Leland-Stanford. The other members of the advisory committee were selected from leading naval architects, shipowners and underwriters.

A preferential load line for oil tankers is being given serious consideration by the committee, because, among other things, the very nature of the cargo itself permits of rapid discharge into the sea, thus not only lightening the vessel but exerting a calming influence on the waves.

If it is difficult to agree on the regulation that should be put into effect regarding coastwise vessels, they could be exempted from the law for the time being, as they seldom go far from safe harbors and the records have not shown that many accidents have occurred in such vessels due to overloading.

The safety and welfare of our ocean-going merchant marine should be protected with a proper load line law at the earliest date, because, as the matter now stands, our vessels may be held up at any time in the harbor of any nation and re-surveyed to ascertain whether or not they are loaded according to the laws of that country. This may become a serious matter, particularly if the discriminatory measures of the Jones Bill are put into effect.

The Seamen's Act

PRESIDENT-ELECT HARDING in a recent speech stated that it was his belief that the Seamen's Act represented the American conscience in regard to the welfare of sailors, and that the United States ought to make good to the shipowners any deficiency that this Act imposed on the operating expenses. The principal objection on the part of shipowners to this law, however, is not the few extra men or the better quarters that the Act specifies, but the lack of control over the crew which the captain suffers due to the fact that under this law a sailor can quit a ship in any port by forfeiting one-half of the wages due him. Friends of the Act claim that this provision tends to equalize the wages of sailors all over the world and that when a foreign ship enters an American port a number of the crew generally desert, compelling the captain to hire a new crew at the prevailing

American wages. Before the passage of the Act we were compelled to use our police powers to round up and return to our competitors any of their deserting crew that it was possible to find.

While it must be recognized that it will be impossible to obtain the right sort of American seamen if the living conditions and wages are unattractive as compared with those which may be obtained on shore, it is just as evident that our ships should not be compelled to undergo the expense and embarrassment of remaining in a port until a new crew can be found. Seamen as well as all other classes of men should be made to live up to their agreements, and in order to bring this about the penalty attached to desertion in the Seamen's Act should be made more severe.

Marine Insurance

MARINE insurance makes it possible for shipping to offer the necessary security for financing its transactions. Shipping, banking and insurance interests should be encouraged to combine and co-operate with each other to the fullest extent, if our merchant marine is to secure its full share of international commerce. If foreign companies are allowed to handle the insurance business, they will acquire vital trade secrets which will be very useful to our competitors. They will know all about our shipments, who is sending and who receiving them, the trade routes of our vessels and the important terms of our commercial transactions.

The greatest obstacle in the way of the development of American marine insurance companies is the conflicting laws of the various states. In order to aid the forty-eight legislatures to secure the unity of action so necessary to the welfare of our country, a model marine insurance bill for the District of Columbia has been introduced in the House of Representatives by Congressman Edmonds. This bill was framed through the close co-operation of the Committee on the Merchant Marine and Fisheries and the Shipping Board after an exhaustive investigation of the whole subject and should form a basis for the states to follow.

The five fundamental ideas incorporated in the bill as interpreted by Dr. S. S. Huebner, expert in insurance for the Shipping Board and Committee on the Merchant Marine and Fisheries, are as follows:

- "(1) Greater freedom on the part of American companies to co-operate through syndicates and mergers;
- "(2) Establishment of the multi-field insurance principle, so that American fire, marine and fire-marine insurance companies may be free to transact all kinds of insurance other than life;
- "(3) Substitution of a system of net profits taxation in place of the present system of taxing gross premiums;
- "(4) Enlargement of reinsurance facilities, and
- "(5) Removal of the limitations on the financial powers of companies which now hamper operations in foreign fields."

The legislative bodies of the forty-eight states should give the above principles their earliest consideration, and a failure to do so may result in the loss of the present opportunity of securing the adequate financial support so necessary to the development of our merchant marine.

 LETTERS TO THE EDITOR

The First Electrically-Driven Passenger Ship

I have noticed in the December issue of *MARINE ENGINEERING* an article which claims that the first turbo-electric driven passenger ship is the *S. S. Cuba*, the General Electric Company having the distinction of furnishing the propelling machinery and the Morse Dry Dock & Repair Company of installing it. If the term "electric drive" may be applied to a turbo-electric propelling unit in which the power is transmitted from the motors to the propeller by means of mechanical reduction gear, I would call your attention to at least one passenger ship equipped with turbo-electric drive about two years ago. This vessel, the *S. S. Ragne*, now in service on the Baltic Sea, was built for Sveabolaget, of Stockholm, Sweden. The machinery was built by Svenska Turbinfabriks Aktiebolaget Ljungstrom, of Finspong, Sweden, and installed by Oscarshams Mekaniska Verkstads Aktiebolag, of Oscarshams, Sweden.

Trenton, N. J. GÖSTA HARTZELL,
Mechanical Engineer and Naval Architect.

Joint Packing on Fuel Oil Heater Line

Not long ago I had occasion to renew a joint on a fuel oil heater line at sea and on taking off the blown out joint I noticed that it was of millboard. No doubt the machinist or pipe fitter that made it up assumed that if millboard is all right on the cargo fuel oil line on deck it should be all right in the stokehold. The result was, however, almost a stop at sea. Steam packing is necessary where oil is carried under pressure, which I realize is nothing new to the old-timer, but there are many marine machinists on your subscription list who are new at the game.

I would also call attention to a little matter not generally known—the provision made for expansion on the top side of a main engine crosshead guide. When, in repair work, it is necessary to remetal the slipper, in making the "pin gage" the crank should be on bottom dead center, thereby eliminating possible error due to the allowance made by the builders in lining up the column.

JACK HARRINGTON.

Robins Dry Dock, Brooklyn, N. Y.

Filters in Lubricating Systems for Geared Turbines

On page 690 of your August issue is published a letter from Mr. Edwin M. May, district manager in New York for the Richardson-Phenix Company, which purports to correct a "gross" misstatement contained in an "article" by Messrs. Schmeltzer and Fernald in the June issue of *MARINE ENGINEERING*.* . . . If the circumstances attending the reprint of the paper had been more clearly defined there would have been little occasion for Mr. May to have criticised it in your columns.

Convention has generally limited the discussion of papers presented at a meeting of an engineering society to its own members or guests. Possibly, however, neither Mr. May nor any member of his company belong to the Society, or, if they are members, they may not have been present at the meeting,

* The article in question, "Lubricating System for Geared Turbines," consisted of an abstract of a paper entitled "Standard Lubricating Oil Systems for Geared Turbines" read by Emile Schmeltzer and B. C. Fernald before the Society of Naval Architects and Marine Engineers in New York on November 14, 1919. This article was published in *MARINE ENGINEERING* by permission of the Society of Naval Architects and Marine Engineers and with full acknowledgment to the Society as the source of the material.—Editor's Note.

but under such circumstances the authors would themselves have been only too glad to have corrected any misstatement injurious to either an individual or a company, had the matter been called to their attention. Since the letter has been published I feel that Mr. May and your readers are entitled to a reply, if for no other reason than to point out that Mr. May's letter is predicated upon what seems to me to be an absolute misquotation of the statements in our paper as reprinted in *MARINE ENGINEERING*.

The second paragraph of Mr. May's letter reads as follows:

"I wish to direct attention to a gross and probably inadvertent misstatement which is made on page 510 in the paragraph entitled 'Filters and Separators.' In this paragraph mention is made of the fact that the centrifugal type of purifier is preferable because in the gravity filter the filtering elements, when placed in the gravity tank, will not function properly unless a sufficient head of oil can be obtained. Furthermore, due to the lack of this head, the oil will follow the line of least resistance and overflow without being filtered."

The paragraph on filters and separators published on page 510 of the June issue of *MARINE ENGINEERING* reads as follows:

"While all of the filters and separators specified are satisfactory for the purpose, it is considered that the results obtained from the centrifugal type of separator show greater efficiency, inasmuch as the oil, water and sediment are separated, the oil flowing from one nozzle, the water from another, the overflow mixture from another, and the sediment remaining in the bowl, from which it may be removed at will. Tests made at Annapolis prove that the rolling or pitching of a vessel will have no ill effects on its successful operation.

"Filtering elements placed in gravity tanks or in the discharge line from pumps to gravity tanks at its connection to gravity tank, unless at sufficient height above, cannot function properly, due to the lack of sufficient head, which results in the oil following the path of least resistance, i. e., through the overflow and not through the straining elements as intended."

Only by deliberate garbling could Mr. May have read from the paragraph in our paper the meaning contained in the second paragraph of his letter.

If the entire paper had been published it would have contained technical order No. 75, which amplifies the filter vs. separator problem. Paragraph 3 of Section "H" entitled "Strainers, Filters or Separators" reads as follows:

"Either a centrifugal separator, or a gravity filter of approved type, must be installed as indicated on Dr. E-11000-10 (Plate 4) with connection for oil supply to separator or filter through both gravity tanks and the reserve tank. The other connections required by the instruction sheet, accompanying the separator or filter, shall also be made. A centrifugal separator will be found especially effective in breaking up an emulsion of water and oil, even in a rough sea. The centrifugal separator can be either electric motor or steam driven. If turbine drive is used, the design should provide for operation against 10 pounds back pressure, so that the turbine can exhaust into the heater. The gravity filter, while effective in cleaning the oil, requires the heating and settling to break up an emulsion. Its effectiveness depends on the use of clean filter cloths. An ample supply of special lintless cloth should be carried on board and frequently changed."

I believe it will be immediately apparent to anyone who reads the above statements made by Mr. Schmeltzer and the undersigned that we expressed a preference for the centrifugal type separator primarily because of its ability to break up an emulsion of oil and water without preheating and settling. In other words, it is effective under sea conditions, which is not the case with any type of gravity filter known to us. Furthermore, the centrifugal separator was considered more convenient to install and operate. The authors of the paper still hold to the opinion that for marine use a good centrifugal separator is decidedly superior to any gravity filter.

The reference to filters placed in gravity tanks or the discharge line of pumps was entirely separated from the paragraph differentiating between filters and separators and had no connection with it. Before the Emergency Fleet Corporation, engineering section, gave attention to the lubricating

system of geared propelling turbines a number of vessels had been constructed in which an attempt had been made to filter the oil by placing filter cloth dams in the gravity tank between the discharge and outlet sides. It is manifest that in order to be effective a filter of this type would have to be capable of handling the entire oil flow of approximately 200 gallons per minute. As the size of the tank was proportioned with regard to the amount of oil to be stored rather than to its ability continuously to filter 200 gallons per minute, the filtering elements proved inadequate to function under the slight head possible with such installations and the filters in service proved to be practically inoperative, hence the comment in our paper in explanation of the rejection of this type of filter by the Emergency Fleet Corporation.

It seems hardly necessary to reply to the balance of Mr. May's letter, as it is not pertinent to his expressed desire to correct a "gross misstatement" in our paper.

New York.

BENJ. G. FERNALD.

NEW BOOKS

Oil Fuel Burning

REVIEWED BY C. H. PEABODY, DR. ENG.

OIL FUEL BURNING IN MARINE PRACTICE. By J. W. M. Sothern. Size, 6 by 9 inches. Pages, 200. Illustrations, 102. New York, 1920: D. Van Nostrand Company; Glasgow, James Munro & Company.

This book is one of a series prepared by the author for use in his Marine Engineering College, Glasgow, which is maintained principally for young engineers who want to qualify for the higher licenses for seagoing marine engineers. These text-books are adapted for their purpose, giving what the aspirant needs to know and not cumbering him with abstruse details. The author says this work has been compiled by request to meet the demand of marine engineer officers for a book containing clear and exhaustive descriptions of various systems of oil burning, combined with general practical information and hints relating to the working of this modern method of steam raising, and he has shown discretion in his solution. He begins with a statement of the advantages and disadvantages of oil fuel, and goes on with such matter as chemistry of combustion, losses due to imperfect combustion and other matters which pertain more or less to all fuels. He gives the usual oil terms, flash point, firing point and viscosity and density, together with a description of instruments to determine these properties and goes into some detail of the use of such instruments. He gives useful tables such as specific gravity combined with the Baumé scale and the pounds per gallon, both British and American, also air velocity for certain drafts.

Having disposed of these introductory matters necessary for the understanding of oil burning, the author takes up various systems of oil burning individually in considerable detail. His method involves a good deal of repetition, but it has the advantage that each system may be read by itself and the engineers may give exclusive attention to the system he is using, if he desires to. Together with the description of the several systems are extensive folding plates and other illustrations necessary for understanding them. All the systems use mechanical sprayers, or they work on the pressure system. For each system a description is given of the burners, furnace mouth, furnace and bridge, method of air control, of pumping and of heating the oil. There are six methods described as used in Great Britain, and also the Babcock and Wilcox method. One of the six is used both in Great Britain and in the United States. For each method directions are given for the care of burners and other apparatus and for starting, running and stopping. The precautions given in

connection with the Babcock and Wilcox method are worthy of mention; of course, they apply to any system.

Having discussed the various systems, the author tabulates the various faults that may be found in burning oil due either to lack of information or proper care, together with the consequences and the methods of detecting each fault. Following this there are given a large number of questions and answers to bring out the essential points of instruction and to allow the student to test his knowledge of the subject.

The work closes with general notes which summarize and present for ready reference the information given, together with certain matters not hitherto presented. In this chapter there is given at length the British Board of Trade instruction concerning arrangements and precautions for burning oil fuel.

Modern History of Warships

REVIEWED BY C. H. PEABODY, DR. ENG.

MODERN HISTORY OF WARSHIPS. By William Hovgaard, professor of naval design and construction, Massachusetts Institute of Technology. Size, 7 by 10 inches. Pages, 501. Illustrations, 209. E. and F. N. Spon, Ltd., London. Spon & Chamberlain, New York.

When arrangements were made nearly twenty years ago for special instruction to officers of the corps of naval constructors at the Massachusetts Institute of Technology, and after a curriculum had been prepared satisfactory to the chief constructor, Commander William Hovgaard, R.D.N., was invited to take the chair of naval design and construction at the Institute. Professor Hovgaard had special qualifications for this position, for in addition to his military training in the Danish Navy he had taken the course for naval constructors at Greenwich, England, and had served as manager of the shipyard of Burmeister and Wain at Copenhagen. A part of his work in the development of his subject is presented in this book; he has already published an important work on "Structural Design of Warships" and has now in press the "General Design of Warships."

A hundred years ago Great Britain had control of the seas and had built up an empire scattered all over the globe. At whatever sacrifice, she has maintained a navy competent to guard that empire; consequently, the history of naval development is a history first of the British Navy, and concurrently of other navies. Such was the order selected by the author in writing this work, with the further condition that he divides the time into periods marked by some notable change or development and in each period deals with the navies of the various countries. At first it is England and France and other countries; then England and Germany and other countries; now it is England and the United States and other countries. Not that the author formally proposes such a mode of procedure or that he adheres to it rigidly, but that the work naturally takes such a form. Since ships last many years, and since the changes do not take place simultaneously in all countries, the periods are not absolute, but the dates named are at least characteristic.

The first period, from 1860 to 1875, is more or less chaotic, marked by two tendencies—first, to put some armor on old types of ships, whether rebuilt or designed new, and, second, to make a new type of ship, namely, the monitor. It is convenient to remember that the original armored dreadnought, the archetype of all modern battleships, was a mastless breastwork monitor, a heavily armored ship with guns in turrets, and a ship with some pretense to seaworthiness.

Dissatisfaction with the breastwork monitor led to various trials in the next fifteen years to construct ships that should carry a few heavy guns and have good speed and seaworthiness. In this period the central battery ship and the barbette ship were developed; both types of ships were doomed as soon as a powerful secondary battery was accepted as a part of the offense of a battleship. Together with these ships

some ships of the breastwork monitor type were built of more satisfactory size, power and seaworthiness.

The modern battleship may be considered to date from the *Royal Sovereign* of 1890, especially for students who are interested in present conditions rather than in archeology. The class of ships of which this was the prototype was thoroughly worked out to fulfill all the conditions of service on any or all the seas of the world under the conditions then existing, especially as affected by ordnance, armor and speed. The design proceeded in an orderly manner, selecting first the battery, then the armor to protect the battery, and the buoyancy, and finally the power and the provision for ammunition and fuel. There was no attempt to put three pints into a great bottle, but sufficient displacement was assigned to make the ships entirely seaworthy and to provide proper height of the guns and wholesome quarters for officers and crew.

The battery consisted of four 13½-inch guns and ten 6-inch guns. When a satisfactory 12-inch gun had been developed that caliber was chosen for the main battery and remained the favorite until recent times. The displacement was 14,150 tons, then considered almost extravagant. This type of ship became the standard, and with modifications and increasing power and speed formed the first line of all important navies until the *Dreadnought* of 1906. The French placed each gun in its own turret and arranged armor in a different manner; the United States scrimped on size and sought for power by using heavier secondary guns, the 8-inch gun long being a favorite, and Germany, by limiting the radius of action and using 11-inch guns for the main battery avoided large displacement. In the competition for power, heavier guns were added to the secondary battery in the British and other navies, 9.2-inch and 10-inch guns being used either with or without smaller guns. The United States stuck to the 8-inch guns for almost all her ships.

The determining course of the latest development of battleships was the improvement in range finding and fire-control, and especially the perfecting of spotting to determine the effect of fire on the target. This demanded that all guns should have the same range, so that definite results could be had; also the perfection of these methods led to salvo firing, a return to the practice of the old wooden line-of-battle ships.

There is nothing new about giving a ship guns of a single caliber, nor about using the largest practicable caliber. When the Civil War opened, the 11-inch smooth bore gun was the heaviest available gun, and the policy was to give all ships that caliber. A ship might have few or many guns, but at least it could reply to fire from any source; but a ship that is outranged is lost—it does not need the experience of the recent war to establish this fact.

When the British Navy laid down the *Dreadnought* a new era opened and all ships already built were relegated to the second class. There was much criticism of the policy because all nations had a chance to begin even except as Great Britain had a slight advantage at the start. The *Dreadnought* carried ten 12-inch guns; the number on later ships by various nations has been increased to twelve or thirteen. Later, in the competition for power, the caliber has been increased to 14 inches and to 16 inches; the larger calibers have also some advantage in range. Various arrangements were devised to get the greatest effective fire in all directions. The United States took the lead in placing all turrets on the centerline and introduced the principle of setting some guns to fire over the adjacent turrets, also of putting three guns in a turret; but here France has gone farther, using four gun turrets. Our latest battleships carry twelve 16-inch guns in four turrets.

The armored cruiser has always been an anomaly because it is given high speed and good seaworthy qualities at the expense of either battery or protection. There are most important duties for the cruiser, and in carrying them out cruisers are likely to fight, in which case the ship which

has the advantage in guns is almost sure to win by outranging the enemy, and protection, even though insufficient, is valuable. But usually an armored cruiser is a fast second-rate battleship, and a sound principle is that all battleships should be worthy to lie in the line.

The apotheosis of the armored cruiser is the battle cruiser, as big as a battleship, as fast as a destroyer and carrying a few guns of the greatest caliber. It is a misnomer to call such a ship a battle cruiser, for it is not fit to lie in the line, as shown by the loss of three British battle cruisers in the battle of Jutland when subjected to the fire of the German fleet. That the British battle cruisers gave them the command of distant seas at the Falkland Islands may justify the construction of such monstrous cruisers for a nation that can afford them. All of this, it is believed, can be justified from the facts given in the book under review. The author on page 227 expresses much the same idea where he demands that certain fast ships are required which should be battleships with as good armor protection, though not necessarily carrying so many guns.

The torpedo is a weapon of surprise and has seldom, if ever, been effective without surprise. The torpedo boat was originally a small, scarcely seaworthy, craft of high speed; its weapon was the torpedo, and its guns were few and feeble. But such a craft is a nuisance, and after various unsuccessful attempts at a reply the torpedo boat destroyer was evolved, being a big seagoing boat of the same type with good armament for its displacement. Then the torpedo boat disappeared and the new powerful boats were simply called destroyers, which is a good warlike name. The torpedo carried by battleships, cruisers or destroyers has for its most effective rôle the forbidding of close range action of large ships, but there are more effective influences forbidding close range action. The destroyer being able and swift has acquired all sorts of duties for which the gun is the primary weapon, as clearly shown by the author.

The author, who has given special attention to submarines, has an excellent chapter on the principles of construction and service of submarines. He divides the submarine into two classes of 600 tons or less for coast defence, and of 1,000 tons or more for sea service. The future is thus stated "with the advent of the steam-driven submersible cruiser of 3,000 tons or more, an entirely new development has been inaugurated, the end of which no one can foretell." He concludes: "The submarine is an important link in the naval defences, but the capital ship remains the supreme type of warship."

Aircraft as forming a part of navies is dealt with briefly; both dirigibles and airplanes or seaplanes are described. "Scouting is the service for which airships are best adapted," and the same remark applies to airplanes. As a weapon against ships they are feeble and uncertain and can hope for success only by surprise under most favorable conditions. Since the author already has a book on "Warship Construction," his chapter on this subject is properly brief. So is his chapter on engines, since he is not writing on marine engineering. His history of archaic engines hardly appears necessary in a book of this sort. His chapter on ordnance is sufficient to show the relation to the history of the warship, and the same can be said of his chapters on armor and on mines. Finally the author sums up the present situation, giving the characteristics for battleships, battle cruisers and other craft. An illuminating recommendation for minor navies is that they should abstain from battleships which they cannot afford and provide only for coast defence by aid of submarines, torpedo boats, air craft and mines.

INVENTIONS, their development and sale, is the title of a book by William E. Baff, patent attorney, recently published by D. Van Nostrand Company, New York. This book is essentially a manual on the marketing of inventions and explains how inventions may be profitably exploited.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in this Department

CONDUCTED BY JAMES L. BATES

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Tonnage Deduction for Machinery Space

Q. (1053).—Quite recently the question of the advantages and disadvantages of the two-cycle against the four-cycle Diesel engine for marine purposes has again been raised and dealt with in various papers. One of the advantages claimed for the two-cycle engine is its reduced length. But is this particular advantage of any value? If my memory serves me right, there is a ruling for the minimum length or cubic contents of boiler and engine room of a ship of a certain displacement, and I think that this minimum length is already reached with our standard four-cycle engines on large transatlantic motor vessels. I do not know whether any of the classification societies make such a restriction or whether it is on account of the way of measurement of registered tonnage, gross, net or underdeck tonnage that only a certain percentage of the total displacement is allowed to be deducted for the engine and boiler room for reasons of calculating the port charges, taxes, etc., on a fair basis. If there is any such restriction, what is the ruling on it? P. R.

A. (1053).—At present there is no fixed ruling as to the length of the machinery space for a cargo steamer. However, the floodable length method of determining the bulkhead spacing which has been suggested by the British Board of Trade and the International Convention for Safety of Life at Sea should be kept in mind, although intended primarily for passenger ships.

You are quite right in stating that if the tonnage of the machinery space reaches a certain percentage (13 percent of the gross tonnage) the deduction for obtaining the net register tonnage is greater than if it falls under this amount, as the following quotation from the tonnage rule indicates:

"The actual space enclosed by the engine room must be calculated and the percentage it bears to the gross tonnage determined to enable the allowance conceded by law to be made. Should this percentage be over 13 and under 20, an allowance of 32 percent may be deducted from the gross tonnage in computing the net register. Should, however, the actual engine room not exceed 13 percent of the gross tonnage, the allowance would then be the actual space plus three-quarters of same."

Hence as the tonnage rule now stands the question of volume of the machinery space should be considered, and it is perfectly possible that a two-cycle Diesel engine would not gain any advantage from its smaller size save in increased cubic capacity of the holds.

Strength of Propellers

Q. (1111).—Will you please inform me how the strength of propellers is figured and the reason for giving the blades a rake aft. J. A. W.

A. (1111).—Seaton's "Manual of Marine Engineering" gives the following formula for thickness of propeller blade:

$$\text{Thickness of blades at } 1\frac{1}{2}d \text{ from center} = \sqrt{\frac{I.H.P. \times f}{R \times n \times b}} \times K.$$

d = the diameter of screw shaft at propeller.

b = the breadth of blades in inches at a distance $1\frac{1}{2}d$ from the center of shaft.

n = the number of blades.

R = the number of revolutions per minute.

f = 100 for compound engines of the ordinary two cylinder type; 90 for three cylinder, compound, four crank, triple and quadruple engines; 85 for three crank, triple compound engines.

K = 4 for cast iron; 2 for ordinary gun metal; 1.6 for cast steel; 1.5 for forged steel and bronzes of high quality.

"For ships engaged in the North Atlantic or on other seas, where rough weather largely prevails, these factors may with advantage be increased by 20 or 25 percent. This is especially necessary for cargo vessels, which may often have to run 'light.'"

"The thickness of metal at the tip should be .2 of that at the root."

For a somewhat more elaborate calculation, reference is suggested to the "Marine Engineers' Handbook" by Sterling, from which the following is largely taken:

T = thickness of blade, in inches (neglecting fillets), at its line of tangency to hub.

W = width of blade tangent to hub, in inches.

$A = 5,252 \text{ I.H.P.} \div (R \times N).$

I.H.P. = actual power required by actual propeller to deliver the effective (tow rope) horsepower of the vessel.

$e.h.p.$ = the net effective horsepower required for the actual speed in knots.

R = revolutions of the propeller per minute.

N = the number of blades.

$B = 0.31 \times \text{diameter of the screw in feet} = 0.31D.$

$C = A \div B.$

$D = 12 \times B$ — radius of hub, in inches.

$E = C \times D.$

$$F = \frac{33,000 \times \text{I.H.P.}}{(P \times R \times N)}$$

$G = 0.345 \times \text{diameter of propeller, in inches.}$

$H = G$ — radius of hub, in inches.

$J = F \times H.$

K = circumference of hub, in feet, $\div P$, in feet.

L = sine of arc whose tangent is $K.$

M = cosine of arc whose tangent is $K.$

$N = L \times J.$

$O = M \times E.$

$P = N + O.$

f = fiber stress as per values of $e.h.p. \div E.H.P.$ given in appended table.

$$T = \sqrt{\frac{13.125 P}{W \times f}}$$

$E.H.P.$ = basic effective (tow rope) horsepower.

For cast iron and semi-steel, $f = 2,500$ to 4,000 for values of $e.h.p. \div E.H.P.$ not in excess of 0.4.

For the strong bronzes, T should never exceed

$$\sqrt[3]{\frac{P \times 2.625}{f}}$$

VALUES OF f TO BE USED FOR DIFFERENT DESIGN POINT VALUES OF $e.h.p. \div E.H.P.$

$e.h.p.$ $E.H.P.$	Constant Torque		Values of f Reciprocating Engines	
	Manganese Bronze	Cast Steel	Manganese Bronze	Cast Steel
0.1.....	4,800	4,300	4,800	4,300
0.2.....	5,500	4,900	5,400	4,850
0.3.....	6,300	5,750	6,000	5,500
0.4.....	7,150	6,650	6,550	6,050
0.5.....	8,000	7,500	7,150	6,650
0.6.....	9,000	8,450	7,750	7,250
0.7.....	9,800	9,300	8,300	7,800
0.8.....	10,750	10,250	8,900	8,400
0.9.....	11,600	11,100	9,450	8,950
1.0.....	12,500	12,000	10,000	9,500

In discussing the rake of propeller blades, Admiral Dyson,

in "Screw Propellers for Hydraulic and Aerial Propulsion," writes as follows:

"It is very common practice to rake the blades aft to a more or less degree, and this practice was generally followed in the United States Navy until a few years ago. There was a generally accepted idea that centrifugal action of the screw was decreased and that efficiency was increased by so doing.

"An examination of the performances of actual screws in service, and of model screws in the tank, shows that there is no solid ground for either belief. In the cases of the actual screws, no difference in the propulsive efficiencies of screws with and screws without rake can be noticed, and the models gave practically identical results. As to centrifugal action, numerous tank experiments have shown the propeller race to be almost cylindrical, and that so far from there being centrifugal action there appears to be a slight convergence abaft the propeller.

"An actual advantage gained by raking the blades aft is that the blade tips of wing screws are given greater clearance from hulls of usual form than if the blades were radial; also, for the same blade clearance the strut arms may be made shorter. Another advantage which the rake may have is in giving greater clearance between the leading edges of the blades and the after side of the stern post and struts, this additional clearance allowing the water a chance to enter the disk at a better angle."

On the other hand, "radial blades, in addition to being as efficient as those with rake, are more easily machined, have less total developed area for equal projected area, and therefore less surface friction, are stiffer and lighter; also, the stresses in the blades due to centrifugal action are less. With propellers of high speed of revolutions, this latter point is very important, and for such screws the blades should never rake."

The Baumé Scale

Q. (1114).—Will you please explain through your columns the relation between Baumé and Baumé hydrometers. Also give the formula for converting readings on the Baumé scale to specific gravity, the scale on the Baumé hydrometer being graduated in units on each side of the zero mark as 1-2-3-4, and each unit divided into quarters. Also please explain the reading of a salinometer. C. C. B.

A. (1114).—The French chemist, Antoine Baumé (1728-1804), devised and used the scales now known by his name in the graduation of hydrometers. There are two Baumé hydrometers. One is intended for use with liquids heavier than water. It sinks to 0 degrees in pure water and to 15 degrees in a 15 percent salt solution. The other is intended for use with liquids lighter than water. It sinks to 0 degrees in a 10 percent salt solution and to 10 degrees in pure water. The graduation in each case is based upon the distance between the points above noted and is carried out along the stem of the instrument to any desired distance.

The degrees in a Baumé scale are of a constant length, while those in a specific gravity scale grow smaller as the density increases. There is, accordingly, no simple relation between the two. The United States Bureau of Standards has determined that the readings on the Baumé scale may be converted to specific gravities by the following formulæ, in each of which *B* is the reading on the Baumé scale:

- (1) For liquids heavier than water, specific gravity = $145 \div (145 - B)$.
- (2) For liquids lighter than water, specific gravity = $140 \div (130 + B)$.

It should be noted that, in comparing the densities of liquids, it is customary to indicate the temperatures in each case; thus specific gravity at 60°/60° F. indicates that the specific gravity of the liquid at 60 degrees F. is referred to water at 60 degrees F. as unity. The formulæ given above are for specific gravities at 60°/60° F.

The hydrometer is an instrument used for determining the densities of liquids, such as water and oil. It consists of a stem near one end of which are fixed two bulbs. The upper bulb is the larger and is filled with air to provide buoyancy. The lower bulb is weighted to maintain the instrument in an upright position. When placed in a liquid the hydrometer sinks until the weight of the liquid displaced is equal to the weight of the hydrometer. Therefore, the denser the liquid

the higher the stem is above the surface of the liquid, and vice versa. In order to utilize this feature for obtaining quantitative results, the stem of the hydrometer is graduated in accordance with some standard such as the Baumé.

Sterling, in the Marine Engineer's Hand Book, page 262, states in substance that the Baumé hydrometer has been generally adopted for the determination of the density of oils lighter than water. For heavy, viscous oils the use of the hydrometer is slow and liable to considerable error. Such oils may be heated to permit the use of the hydrometer, due correction being made for the change in temperature.

The second part of your question relates to the reading of a salinometer. The salinometer is a form of hydrometer commonly used for determining the presence and amount of sea or salt water in a marine boiler. The Marine Engineer's Hand Book, page 381, gives the following:

"The salinometer scale had its origin in the assumption that sea water contains 1 pound of salt dissolved in 32 pounds of water; thus, sea water is supposed to be 1/32 salinity. This is not strictly correct, as sea water varies somewhat in saline content. However, the salinometer scale indicates that according to the number of thirty-seconds on the scale there is a corresponding amount of salt in pounds for each 32 pounds of water."

In accordance with the foregoing, the salinometer readings are in thirty-seconds and are stated as one thirty-second, one and one-half thirty-seconds, etc.

The density of water is affected by its temperature, and this must also be taken when the salinometer readings are made, the salinometer being standardized for a certain water temperature.

Number of Oil Burning Vessels

Q. (1117).—Is any information available as to the number of ships now being fitted for burning fuel oil and also as to the probable results on the supply of fuel oil? What are the relative prices of fuel oil on the Atlantic coast, the Gulf and the Pacific coast?

A. (1117).—The "Register of United States Shipping Board Vessels" for 1920 shows 1,476 vessels; of these, 841 are coal burners and 635 oil burners, but of the coal burners 115 are under 3,000 tons deadweight (tugs, etc.). You probably know of the recent acute fuel oil shortage at the Atlantic coast ports. Current fuel oil prices are subject to fluctuation. The United States Shipping Board was able to contract last year with various companies as follows: The prices for oil at the Canal Zone were only slightly higher than those at the North Atlantic ports, the latter being perhaps 20 percent higher than the price at the Gulf ports near the fuel oil fields. The most recent quotations obtainable show that at Atlantic ports and in the Canal Zone the prices are practically the same, being about 40 percent higher than at Pacific ports. The price at the Gulf ports is between that on the Pacific and that at Atlantic and Canal Zone ports. In order to conserve fuel oil for the use of the merchant marine where it shows such great savings in greater deadweight capacity and smaller personnel it would seem as though all countries should discourage stationary plants from using it.

LAUNCH OF FRUIT STEAMER.—The Newburgh Shipyards, Inc., Newburgh, N. Y., recently launched the *Choluteca*, one of three similar vessels under contract by them for the Cuyamel Fruit Company of New Orleans. This vessel is of interesting type, inasmuch as it is especially constructed for the carriage of fruit (principally bananas), and passengers from Central American countries. The *Choluteca*, which is designed to carry a deadweight of 2,100 tons on a draft of 17 feet, and to have cargo hold capacity of about 140,000 cubic feet, has been built under the supervision of William Gardner & Company, naval architects, of New York, and will fly the flag of Nicaragua, the port of registry being Puerto Cortez. Accommodations have been arranged for a maximum of thirty-two first-class passengers in twelve staterooms.

PERSONAL MENTION

LOUIS A. DELANEY, formerly mechanical engineer with F. X. Hooper Company, Glenarm, Md., is now manager of the American Sheet Metal Corporation, of Philadelphia, Pa.

HARRY DE LAPOTTERIE has resigned his position with the Townsend Company, of New Brighton, Pa., to become industrial engineer of the Falls River Company, of Kent, Ohio.

L. E. GEARY, former naval architect for the United States Shipping Board on the Pacific coast, has established himself in business at Seattle as a naval architect, engineer and broker.

D. T. WARDEN, formerly manager of the marine department of the Standard Oil Company of New Jersey, has become manager of the tank steamer department of the Tidewater Oil Company.

HARRIS MCDUGAL, of the McDougal-Duluth Shipbuilding Company, Duluth, Minn., is in Europe in connection with a proposition to open up a ship repair plant in or near the port of New York.

W. F. GIBBS, chief of the construction department of the International Mercantile Marine Company, New York City, has returned to New York after a European trip in company with President P. A. S. Franklin.

C. C. MOSS, hull surveyor for the Munson Steamship Line, New York City, has been appointed resident hull inspector on the new passenger ship being built by the New York Shipbuilding Corporation for the Munson Line.

FRANK E. KIRBY, retired naval architect from the Great Lakes, who was consulting engineer for the Submarine Boat Corporation, Newark Bay, N. J., during the war, has recently returned from an extended pleasure trip through China and Japan.

CAPTAIN L. H. ELLISON, formerly with the United States Shipping Board and the Federal Shipbuilding Company, Kearny, N. J., has been appointed electrical engineer of the United States Mail Steamship Company, Inc., New York City. Captain Ellison graduated from the Virginia Military Institute in 1909, and from then until 1916 was connected with the United States Navy Yard at Norfolk, Va., in the electrical department. From January, 1916, to May, 1917, he was with the Western Electric Company at the Chicago plant as engineer in the manufacturing methods department, investigating methods and machinery developments. During the war, Captain Ellison served in this country and in France with the 37th Engineers and as engineer officer with the army transport service. After release from service in 1919 until his present connection with the United States Mail Steamship Company, Captain Ellison was with the Shipping Board in New York and the Federal Shipbuilding Company. He is a member of the American Institute of Electrical Engineers and of the American Association of Engineers.



Capt. L. H. Ellison

A. POHLMAN, well known in the combustion field, is now with the engineering department of the Diamond Power Specialty Company, Detroit, Mich.

ROBERT L. HOGAN, formerly chief hull draftsman for the Foundation Company at New Orleans, has resigned with the closing down of the yard and is now connected with the Newport News Shipbuilding and Dry Dock Company, Newport News, Va.

A. E. SAUNDERS has recently joined George G. Sharp as partner in the latter's practice as consulting naval architects, engineers and marine surveyors at 30 Church street, New



A. E. Saunders

York City. Mr. Saunders has been engaged in shipbuilding in all its branches over a considerable period, and after receiving his training and technical education in Great Britain entered the service of the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., as draftsman in the general drawing office and afterwards in the scientific department. On leaving Newport News he joined the scientific staff of the New York Shipbuilding Company, Camden, N. J., as estimating

and designing draftsman and afterwards as assistant naval architect over a period covering eight years. On the formation of the Sun Shipbuilding Company, Chester, Pa., Mr. Saunders accepted the position of naval architect with that company, assuming full responsibility for the design of the tankers and freight steamers under construction at the yard. These vessels have given satisfactory service through a number of years of service and formed the basis on which standard vessels of this company were designed. Mr. Saunders later joined the technical staff of the American Bureau of Shipping as assistant to the chief surveyor covering the Philadelphia and Baltimore districts, and in that position had opportunity to become conversant with the inner workings of a classification society; ultimately, Mr. Saunders entered the construction department of the International Mercantile Marine Company as naval architect, from which position he resigned to engage in his present association with Mr. Sharp. Mr. Saunders is a member of the Society of Naval Architects and Marine Engineers and is also a member of the Institution of Naval Architects.

JOHN J. MUIR, who until recently was connected with the United States Shipping Board Emergency Fleet Corporation, has opened offices at 2012 L. C. Smith building, Seattle, Wash., to engage in practice as a consulting engineer in marine and general engineering work. Mr. Muir has had considerable and varied experience in both lines of work in this as well as in foreign countries, including Calcutta, East India, having been engaged in the design and construction of marine engines for all kinds of service, and also the construction and operation of light draft steamers, barges and oil carrying steamers. His experience in general engineering work included the design and construction of Corliss and piston valve engines and rope transmission machinery for various kinds of heavy duty service, as well as ordinary service. Mr. Muir is a member of the American Society of Mechanical Engineers and the Engineers' Society of Western Pennsylvania.

C. W. WEAVER, who has acted as superintendent of hull construction at the Harlan plant of the Bethlehem Shipbuilding Corporation, Ltd., for the past four years, assumed the duties of general superintendent on December 1. This promotion was occasioned through the elevation of superintendent of machinery R. S. Campbell to the same post at the Sparrow's Point, Maryland, yard of the Bethlehem Shipbuilding Corporation, Ltd.

R. S. CAMPBELL, formerly superintendent of machinery at the Harlan plant of the Bethlehem Shipbuilding Corporation, Ltd., assumed on December 1 the same duties at the Sparrow's Point yard of the Corporation at Sparrow's Point, Maryland. Mr. Campbell has been directing head of the machinery department at the Harlan plant since January 1, 1917. The Maryland yard has a building capacity just double that of the Delaware yard.

SHIP REPAIR FACILITIES IN THE UNITED STATES

(Continued from page 81.)

REPAIR PLANT AND LOCATION.	MARINE RAILWAYS. CAPACITY IN TONS.	FLOATING DRY DOCKS. CAPACITY IN TONS.	GRAVING DOCKS. DIMENSIONS.	SHOPS.	SPECIALIZE IN REPAIRS TO
Southern Shipyard Corp., Newport News..	3,000				General repairs.
Warwick Machine Company, Newport News					General repairs.
Washington					
Ballard Marine Railway Company, Inc., Seattle.....	600 400				General repairs.
Robert Campbell & Bros., Seattle.....	80' x 30'				General repairs.
J. F. Duthie & Company, Seattle.....				Laying Out Shop, Mold Loft, Blacksmith Shop, Boiler Shop, Copper Shop, Machine Shop, Joiner Shop, Forge Shop, Plate Shop, Furnace Shop, Anglesmith Shop, Sheet Metal Shop, Carpenter and Pipe Shop.	General repairs.
Elliott Bay Shipbuilding Company, Seattle	600				General repairs.
Fishing Vessel Owners Marine Ways, Inc., Seattle.....	300 200				Wood vessels.
J. C. Johnson, Port Blakely.....	200				Wood vessels.
H. R. James Company, Seattle.....	1,300				General repairs.
D. W. Hartzell, Inc., Eagle Harbor.....	500				General repairs.
King & Winge Shipbuilding Company, Seattle.....					General repairs.
McAteer Shipbuilding Company, Seattle..	1,000				Wood ships.
Marine Iron Works, Seattle.....	4 Marine Railways				General repairs.
Maritime Boat & Engine Works, Seattle....	500				Tugs and barges.
Norway-Pacific Construction & Dry Dock Company, Everett.....		20,000			Steel ships.
Price Construction Company, Houghton..	2,000				Wood ships.
Todd Dry Dock & Construction Company, (Todd Shipyards Corp.), Tacoma.....				Foundry, Pattern Shop, Anglesmith Shop, Mold Loft, Machine Shop, Blacksmith Shop, Boiler Shop, Joiner Shop, Paint Shop, Copper Shop, Pipe Shop, Rigging Loft and Carpenter Shop.	Steel vessels.
Todd Dry Dock, Inc. (Todd Shipyards Corp.), Seattle.....		4,000	Two docks of 12,000 tons capacity each.	Completely Equipped Plant.	General repairs.
West Virginia					
Kanawha Dock Company, Point Pleasant..		Sectional Dock 50'x200'			River craft.
Point Pleasant Dry Dock Company, Point Pleasant.....			212' x 56' x 11' water O. S.		River craft.
H. A. Wintus, Parkersburg.....		4 Section Dock			River craft.
Wisconsin					
American Shipbuilding Company, Milwaukee.....			311' x 45' x 12½' water O. S. 445' x 61' x 14½' water O. S.		General repairs.
American Shipbuilding Company, Superior..			609' x 66' x 15½' water O. S. 620' x 66' x 20' water O. S.	Paint Shop, Woodworking Shop, Rigging Loft, Plate Shop, Blacksmith Shop, Machine Shop, Carpenter and Joiner Shop.	General repairs.
Leathem & Smith Towing & Wrecking Company, Sturgeon Bay.....			248' x 41' x 14' water O. S.	Blacksmith Shop, Machine Shop.	Tugs and barges.
Manitowoc Shipbuilding Corp., Manitowoc..		360' x 70'	340' x 44' x 12½' water O. S.	Machine Shop, Electrical Shop, Tin Shop, Joiner Shop, Planing Mill, Mold Loft, Pipe and Coppersmith Shop, Pipe Bending Shop, Pipe Shop, Paint Shop, Blacksmith Shop, Plate Shop, and Angle Shop.	Steel ships.
Racine Boat Company, Racine.....	100' long				Yachts.
Ryan & Son, Oshkosh.....	300 300				River craft.
Sturgeon Bay Dry Dock Company, Sturgeon Bay.....		1,200			General repairs.

Shipbuilding and General Marine News

Contracts for New Ships—Shipyard Improvements—
Engineering Projects—Improved Appliances—Personal Items

MILLIONS WORTH OF SHIPS UNDER DESIGN AND SUPERVISION OF TWO NEW YORK NAVAL ARCHITECTS

Several Types of Vessels, Including Tankers, Freighters and Passenger Ships to be Constructed in 1921

Although some are pessimistic regarding the immediate prospects for shipbuilding, it was learned by MARINE ENGINEERING that one prominent naval architect alone has \$45,000,000 worth of work on his boards and under his supervision, while another similar firm has under its design and supervision several new vessels and the conversion of two others.

Theodore E. Ferris, naval architect and marine engineer, of 30 Church street, when interviewed, had his coat off and sleeves rolled up, as in the days when shipbuilding was at its peak. Mr. Ferris stated that he has under his design and supervision 14 oil tankers for the Atlantic Gulf & West Indies Steamship Company and their subsidiaries; a combination cargo and passenger vessel for the Munson Steamship Line; two passenger ships for the Red "D" Steamship Line, the contracts for which are about to be placed; and several other designs of proposed oil tankers and passenger vessels, concerning which he does not feel at liberty, at this time, to give out details. Mr. Ferris is also in charge of the reconditioning of the *Brazos*, of the New York & Porto Rico Steamship Company, and the *San Jacinto*, of the Mallory Steamship Company.

Messrs. George G. Sharp and A. E. Saunders, naval architects, of 30 Church

street, have the following work under their design and supervision:

One single-screw molasses steamer under construction at the Curtis Bay Copper & Iron Works, Baltimore. This vessel is of the three-island type, and has a deadweight capacity of 2,600 tons. She is fitted with triple expansion engines and has a designed speed of 12 knots.

One bulk oil barge for the Terry Shipbuilding Company, Savannah, Ga.; a two-masted, seagoing tow barge, having a deadweight capacity of 3,600 tons.

One salvage steamer for South American owners, the contract for which is not placed. This is a twin-screw vessel having a designed speed of 14 knots. She is to be equipped with wrecking and large pumping machinery.

Seven Hog Island Type A steamships to be converted to bulk oil steamers. Five of these vessels are for the American Fuel Oil & Transportation Company, and two for Charbonneau, Rajolo & Company. These vessels have a deadweight capacity of 7,500 tons.

Several five-masted schooners to be converted from standard Shipping Board wood steamers for Italian owners. These vessels are intended for the coal trade and have a capacity of 4,000 deadweight tons.

NEW YORK SHIPBUILDING CORPORATION ACTIVITIES

Construction activities continue brisk at the yard of the New York Shipbuilding Corporation, Camden, N. J. According to the latest announcement from that corporation, work is being conducted on a total of thirty ships. Due to the capacity of the yard, however, which has over 19,000 men on the payroll, the corporation is in a position to accept additional contracts and to offer as favorable delivery dates as any other yard in this country or abroad. The list of work on hand at the plant at the present time is as follows:

Of the sixteen combination passenger and cargo vessels ordered by the United States Shipping Board, three of them are delivered and the rest will follow at short intervals.

Four 12,600 deadweight ton tankers for the Standard Transportation Company, of New York (Standard Oil Company's marine department).

One 9,820-ton tanker for the United Fruit Company. The ship has been launched and is scheduled for early delivery. One duplicate of this boat for the Pacific Mail Steamship Company, which, it is expected, will be delivered late in the spring.

Two more of the same type which are being built as stock boats for sale. These are expected to be completed in the late summer and early fall respectively.

One passenger liner for the Munson Steamship Company which should be ready for launching about the middle of 1921.

The yard has completed an order for thirty destroyers, five of which remain to be delivered early in 1921. The corporation also has under construction for the navy, two large electrically driven battleships and one battle cruiser.

W. L. PEEBLES NAMED AS NEW YORK MANAGER

Announcement is made of the appointment of W. L. Peebles as New York manager for the Marine Decking & Supply Company, with offices at 3708 Woolworth building, New York City. Mr. Peebles was formerly associated with the Pennsylvania Railroad at New York and Baltimore, and the Philadelphia & Reading Railroad, at Philadelphia.

The Marine Decking & Supply Company deals extensively in litorislo, tackle blocks, paints, boiler cleaning and scaling, etc. It is a manufacturing company, with factories in Philadelphia and Easton, Pa. It is claimed that approximately 80 percent of the decking on the larger ships of the United States is of litorislo, which material is fire, water and vermin proof.

FIRST OF TEN SCOUT CRUISERS LAUNCHED

The *Omaha*, scout cruiser number 4, the first of ten such vessels authorized by Congress in its 1916 building program and said to be the first vessel of this type to be built for the Navy in thirteen years, was launched at the Tacoma, Wash., plant of the Todd Shipyards Corporation on December 14. Its predecessors were the *Chester*, *Birmingham* and *Salem*, launched in 1907. The *Omaha* is of 7,500 tons displacement 550 feet 6 inches over all length, 55 feet 4 inches beam, with a mean low draft of 13 feet 6 inches. She is equipped with four engines developing 95,000 indicated horsepower and will maintain a speed of 35 knots.

The *Omaha* was sent into the water bow first instead of stern first.

DR. W. L. R. EMMET AWARDED GOLD MEDAL

The Franklin Institute of the State of Pennsylvania, acting through its committee on science and the arts, at its meeting on November 17, 1920, awarded to Dr. W. L. R. Emmet, consulting engineer of the General Electric Company, Schenectady, N. Y., its Elliott Cresson Gold Medal. The wording of the award is as follows:

"After a careful consideration and study of Dr. Emmet's work relating to ship propulsion, the institute is of the opinion that it deserves the highest award in its gift for the recognition of inventions of signal importance and awards to Dr. W. L. R. Emmet the Elliott Cresson Medal in recognition of his notable contribution to The Art of Ship Propulsion."

BUSINESS NOTES

The Metal & Thermit Corporation, New York, in order to take care of its rapidly increasing business in the New England territory, has opened a branch office at 141 Milk Street, Boston. Inquiries addressed there will have the personal attention of the New England District Manager, Robert L. Browne. Orders, however, should continue to be addressed to the General Office of this company at 120 Broadway, New York.

The Oxweld Acetylene Company announces the appointment of the Standard Supply & Equipment Company, of New York and Philadelphia, as eastern sales agent for eveready welding and cutting apparatus and supplies.

The Standard Supply & Equipment Company deals in shelf and heavy hardware, machinery, mill and mine supplies, automobile accessories, etc., and has, besides its New York and Philadelphia establishments, branch houses in New Haven, Hartford, Springfield, Worcester, Pittsburgh, Trenton and Altoona. The company has appointed as manager of its welding and cutting equipment department, Mr. George E. Temple, for six years connected with the Prest-O-Lite Company, which formerly manufactured and marketed the apparatus now everywhere known as "Eveready."

The George A. Fuller Company has completed its contract with the United States Shipping Board Emergency Fleet Corporation with the delivery of the steamship *Syros* by the Carolina shipyard of that company. The *Syros* was the eighth 9,600 deadweight ton cargo steamship delivered to the Fleet Corporation by this contractor within a period of ten months. The Carolina yard is now engaged solely in the construction of oil tankers, the first of which will be delivered to British owners during January.

Frank Thornton, Jr., chief engineer of the Westinghouse Electric Products Company, has been appointed manager of the electric heating department of the Westinghouse Electric & Manufacturing Company. Mr. Thornton was graduated from the University of Missouri in 1908, spent a year studying in Europe and joined the Westinghouse Company in May, 1909.

Announcement is made of the change of name of the Lewis & Roth Corporation to the Electric Power Equipment Corporation, Philadelphia. This change affects the name only, the personnel, sales policy and manufacturing product remaining the same.

The consolidation of the Whiting Foundry Equipment Company of Harvey, Ill. and the American Foundry Equipment Company of New York City, recently announced, has not been consummated and the two companies will continue as separate concerns the same as heretofore.

O. E. Falls, who has had many years of experience in charge of foundry and thermite welding work at the Norfolk Navy Yard, Portsmouth, Va., has accepted a position with the Metal & Thermit Corporation, New York. Mr. Falls obtained his earlier foundry experience from positions held at the Norfolk & Western Railway

Shops, Roanoke, Va.; the Richmond Locomotive Works, Richmond, Va., Pennsylvania Engineering Works, New Castle, Pa.; the Franklin Air Compressor Works, Franklin, Pa.; the Seaboard Air Line Railway Company's Shops, Portsmouth, Va.

"Little David" Couplings

A hose coupling with several new features has recently been placed on the market by the Ingersoll Rand Company, New York. This device is called the "Little David" hose coupling and will be distributed as an accessory to the line of pneumatic tools manufactured by the same company.



Pneumatic Hose Coupling

The design of the "Little David" coupling has been with the view to overcoming these troubles. The coupling consists of two parts, male and female. The female end is fitted with a V-shaped rubber gasket providing an air tight joint. The gasket is prevented from blowing out should the coupling accidentally be disconnected under pressure, by a protective shoulder inside the coupling. The female end is exceptionally sturdy, there being no exposed parts which might be liable to injury and cause jamming or sticking. The locking shoulders are heavy with large bearing surface. The locking spring can be replaced if necessary.

"Little David" hose couplings are manufactured in $\frac{1}{2}$ -inch and $\frac{3}{4}$ -inch sizes, which are interchangeable; that is, a $\frac{1}{2}$ -inch male piece may be used with a $\frac{3}{4}$ -inch female end or vice versa. Gaskets are also interchangeable between the different sizes.

New Immigration Service

With the sailing on Christmas Day of the steamship *Mount Clay* of the United American Lines, from New York to Hamburg, a service will be inaugurated which marks a new era in immigrant ocean travel.

The *Mount Clay*, which was formerly the *Prinz Eitel Friedrich*, is a twin-screw steamer of 10,000 tons, capable of making 15 knots. It has been entirely refitted for third-class passenger accommodation, and affords convenience and comfort that were unknown to third-class or steerage passengers in the days before the war.

It is the intention to add five other steamships to this third-class passenger service between Hamburg and New York, so that by the beginning of summer there will be regular weekly sailings.

New Oil Tanker

The oil tanker, *District of Columbia*, left the ways at the south plant of the Baltimore Dry Dock & Shipbuilding Company, at noon, Saturday, December 18, 1920.

She is of 10,300 deadweight tons, 430 feet in length, 59-foot beam; 33 feet, 3 inches in depth, will have 2,650 shaft horsepower; single screw; geared turbines; with a speed

of 10 knots; equipped with three Scotch boilers, oil burning; forced draft; having a cargo capacity of 3,000,000 gallons.

Navy Program Moving

The United States Navy's shipbuilding program is being carried steadily forward, according to the annual report of the Secretary of the Navy for the fiscal year ended June 30, 1920, and issued December 13, 1920. In connection with the three-year construction program of 1916, the report says in part:

"Construction of the 16 capital ships authorized in the three year program of 1916 is now going forward. Suspension of work on them during hostilities enabled our construction engineers and naval experts to take advantage of war experiences of other countries as well as our own to make a thorough study of latest developments so as to embody the most modern improvements in its structure and armament. These battleships of 43,200 tons and battle cruisers of 43,500 tons will be larger and more powerful than any heretofore built and without equal in speed and gun power."

In a statement issued by the department it is set forth that "the electrical operation of the navy's new line of six battle cruisers now building under the 1916 naval program will represent, according to Rear Admiral R. S. Griffin, chief of the Bureau of Engineering, the greatest horsepower per shaft that has ever been projected in any marine installation, irrespective of type of motive power."

According to the naval report of Rear Admiral David W. Taylor, chief of the Bureau of Construction and Repair, nearly 200 warships, including one superdreadnaught and 96 destroyers, were completed in the United States in the fiscal year ended last June 30, and more than 100 others, including 11 superdreadnaughts, were building at that time. Admiral Taylor estimated that \$119,000,000 would be required in the fiscal year beginning next June 30 for continuing work on the ships building.

Noteworthy Performance

The splendid performance of the steamship *Kandahae*, owned by Ellerman & Bucknell, has recently attracted considerable attention. This vessel is of 10,750 deadweight tonnage, equipped with triple expansion engines, with cylinders $25\frac{1}{2}$ inches, $43\frac{1}{2}$ inches, and 76 inches diameter by 51 inches stroke, developing 3,200 indicated horsepower at a speed of 12 knots. It is fitted with three single end Scotch boilers with Howden forced draft, and with fire tube superheaters delivering 200 degrees at the main engine throttle. She burns about $42\frac{1}{2}$ tons of coal per 24 hours or about 1.24 pounds of coal per indicated horsepower for all purposes. This vessel has been operating since 1913.

Shipmasters Join Neptune Association

By a vote that was virtually unanimous, the Shipmasters' Association of the United States, with headquarters at Seattle, Wash., has decided to disincorporate and join the powerful Neptune Association, with headquarters in New York.

AMERICAN SHIPS CARRY BIG VOLUME OF FOREIGN TRADE

Merchant Fleet Increased by 670 Vessels—Additional Funds Asked for Overseas Commerce

A new high record for foreign trade was established by American ships according to the annual report of Secretary Alexander, of the Department of Commerce, which states that they carried nearly one-half of the nation's overseas commerce during the past fiscal year. The figures indicated that the overseas trade reached the unprecedented total of \$11,875,424,000 and \$5,071,905,000 of this amount was carried in American owned vessels as against \$368,359,000 carried in American ships the year before the war.

The American merchant fleet during the last fiscal year was increased by 670 vessels of 3,516,000 gross tons, Mr. Alexander also shows, and on June 30, American shipping comprised 28,183 vessels of 16,324,024 gross tons as compared with 7,928,688 tons in 1914. Growth of American shipping, the report says, has been wholly in the foreign trade, much more than half of that growth having taken place since the armistice of November 11, 1918.

In connection with the growth of American shipping in foreign trade, Mr. Alexander discussed the advisability of charging off "to the winning of the war" sufficient of the war cost of the Government owned ships to enable them to compete with foreign shipping on the basis of actual value of the properties. The secretary expressed the belief that American exporters would find it "increasingly difficult" to maintain their vessels in foreign markets without adequate Government aid, and he urged Congress to provide for the expansion of the foreign attaché service and asked for increased appropriations to be used in the promotion of foreign trade. For Latin-American trade development Mr. Alexander recommended expenditures of 50 percent more than was used in this field last year.

Estimates of appropriations required for the department of commerce for the fiscal year of 1922 were placed by the secretary at \$30,383,481, an increase of \$10,121,712 over those of the past year.

Launching Records Broken

The world's pre-war record of launchings during the last fiscal year was broken by American shipbuilders, according to figures given in the annual report of the Commission of Navigation, at Washington. American ships built and documented during the year aggregated 3,880,639 gross tons, the report stated, adding that British ships under construction on June 30, 1920, aggregated 3,808,056 tons. American shipyards reached a rate of 4,258,141 gross tons a year at the end of December, 1919, the report shows, and at the end of March, 1920, they had built steel ships alone at the rate of 3,679,185 tons a year, a small portion of these being foreign tonnage.

Up to July 1, last, American tonnage sufficient to carry 60 percent of the foreign trade of the United States had been registered. During the year, American ships actually carried 45 percent in value of the exports from the United States, and 39 percent of the imports, the report sets forth. American ships in 1914 carried but 10 percent of this country's exports and imports.

Navigation Bureau Report

The Bureau of Navigation, Department of Commerce, Washington, D. C., reports 118 sailing, steam, gas and unrigged vessels of 213,957 gross tons built in the United States and officially numbered during the month of November, 1920. Of this number, twenty-six were steel steamers totaling 134,649 tons. From other sources than construction, two vessels of 17,889 gross tons were admitted to American registry.

American Design Will Be Used for Italian Ships

A. C. Rimmer, consulting engineer and naval architect, 149 Broadway, New York, is completing the shipment to Italy of a large amount of fabricated steel that was left in this country due to cancellations of contracts for 9,000-ton steel steamers by the United States Shipping Board.

A large part of the material is completely fabricated and ready for erection. Other parts of the hull are only partly fabricated while other material is only in the plain state as received to shipbuilder's specifications from the steel mills. The fabricated and semi-fabricated material has been gathered together from the many structural plants throughout the country who were fabricating this type of ship and has been sorted, inspected and shipped in such a manner that the sections can be used in Italy for ships of American design and on the American fabricated principle with very little waste. The units were shipped in such a manner that construction could be started as soon as the first material arrived abroad so that we shall soon see coming to our shores under a foreign flag vessels designed and partly built in this country.

The vessels as built in this country were equipped with watertube boilers and geared turbines, but it is the intention of the Italian shipbuilders to install oil burning Scotch type boilers and reciprocating engines.

Mr. Rimmer has also handled the shipping of a large amount of shipyard and shipbuilding equipment and stock for the construction of vessels of Italian design.

Two More Ships Launched

Recent launchings by the New York Shipbuilding Corporation include two ships, the *Lone Star State* and the *Centennial State*. The *Lone Star State* is one of sixteen passenger and cargo ships for which the company was given orders during the war by the Emergency Fleet Corporation. These boats were originally intended for transports, but with the signing of the armistice they were held up and eventually changed to passenger and cargo liners. Three have been delivered, the balance were launched with the exception of two, which will be launched the early part of 1921, and all are well under way. The *Lone Star State* is 21,000 displacement tons, the *Centennial State* of 13,000 deadweight tons.

Arrange Winter Lectures for Ocean Engineers

The Educational Department of Ocean Marine Engineers' Beneficial Association, Number 80, 15 Whitehall Street, New York City, has arranged for a series of lectures on modern marine propelling and auxiliary equipment, these lectures to be given every Tuesday evening during the winter.

On December 21, the lecturer, H. B. Taylor, chief engineer of the turbine department, Division of Construction and Repair, United States Shipping Board, spoke on the development of the marine turbine up to the present day geared type. This lecture was well attended by superintendent engineers and operating marine engineers, and Mr. Taylor was given an enthusiastic reception, his talk being looked upon as a long step forward in the educational work conducted by the organization.

On Tuesday, December 14, P. J. Henning gave a very instructive lecture on "Turbo Electric Drive" explaining in detail the operation of the ship *Eclipse*.

Shipping Board Approvals

The Shipping Board has approved applications for the construction in accordance with the provisions of Section 23, of the Merchant Marine Act, 1920, submitted by the following companies of the vessels indicated in order that they may obtain the benefits of the provisions of the said section:

Alaska Steamship Company, 120 Broadway, New York City, 6,000-ton twin-screw cargo motorship, Todd Drydock & Construction Company, Tacoma, Wash.; Calvert Navigation Company, Baltimore, Md., steel tanker, 10,200 tons deadweight, Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md.; Sinclair Navigation Company, 120 Broadway, New York City, two bulk oil tankers of 6,900 deadweight tons each, Bethlehem Shipbuilding Corporation, Harlan Plant, Wilmington, Del.

Section 28 Further Suspended

At a general session of the Interstate Commerce Commission held at its office in Washington on December 11, it was ordered that the provision of Section 28 of the Merchant Marine Act of 1920 be further suspended from and including the first day of January, 1921, until further order of the commission.

AMERICAN STEAMSHIP LINES PLAN CONSTRUCTION OF NEW VESSELS

Shipbuilding is believed by many to have taken a decided turn for the better. One of the chief influences to this end is seen in the announcement that more than fifteen United States steamship lines have filed notices with the Treasury Department that they intend to take advantage of Section 23 of the Merchant Marine Act of 1920, whereby excess profits earned by American ships engaged in foreign trade are exempt from taxation, provided they are to be reinvested in the construction of new ships.

It is stated that the American Line had deposited a large sum of money with a New York trust company, and had notified the Internal Revenue Bureau and the Shipping Board that it proposed to invest the amount exempted from taxation in new construction of American-flag vessels. The controller of the American-Hawaiian Steamship Company stated that he had followed similar procedure. The Kerr Steamship Company, through its attorneys, has made application to the Shipping Board to be permitted to reinvest the money which it realized from the sale of the seven ex-Austrian steamers to the Harriman interests, while other companies are reported to have taken similar action. The Munson Steamship Line, it is reported, will ask that the exemption from excess profits taxes of its ships engaged in foreign trade be made applicable to the 6,000-ton passenger liner which it is building at the Camden plant of the New York Shipbuilding Corporation.

Contracts for two motorships to be built by the Merchant Shipbuilding Corporation have been awarded by the American-Hawaiian Steamship Company. The American Line has drawn up plans for two passenger liners, although the contract has not yet been awarded. The Red "D" Line, the Pacific Steamship Company, and the New York & Porto Rico Steamship Company are also reported to have plans prepared for passenger liners.

26 SHIPS UNDELIVERED

Shipping Board Has Many Vessels at Delaware Yards

Announcement in Washington that the United States Shipping Board had applied to Congress for a deficiency appropriation of \$95,000,000 to complete ships now under construction, gave rise to unfounded rumors that changes might be made in the Government's shipbuilding programme, which would result in the cancellation of some vessels now under construction in Delaware River shipyards. These rumors were promptly denied by local officials of the Emergency Fleet Corporation, who pointed out that even if cancellations were being considered, they could not be made because of the advanced nature of the work on ships being built for Government account.

The Atlantic Coast Shipbuilders' Association's Philadelphia office learned from an official of the Emergency Fleet Corporation, that there remain under construction on the Delaware River for the United States Shipping Board twenty-six vessels being built at five different shipyards, all of which are expected to complete their schedules by March 1, except the New York Shipbuilding Corporation, which has several combination passenger and freight ships that will not all be delivered before September 1, 1921.

The Chester yard of the Merchant Shipbuilding Corporation, the Sun Shipbuilding Company, and the Gloucester and Wilmington plants of the Pusey & Jones Company, have delivered all vessels for Government account.

HARLAN PLANT PRODUCTION

With the delivery of a cargo ship and a tanker in December, the Harlan plant of the Bethlehem Shipbuilding Corporation, Ltd., at Wilmington, Del., rounded out a production year of 67,500 tons for a five-year yard.

The late 1920 deliveries included the last Emergency Fleet contract, the *Natirir*, a 7,400-ton cargo carrier, and the *Eugene V. R. Thayer*, a 12,600-ton tanker for the Sinclair Navigation Company. December also saw the launch of another 12,600-tonner for the Sinclair Navigation Company, the *Albert E. Watts*, making nine ships accepted and ten launched.

COMPLETES GOVERNMENT SHIPBUILDING PROGRAMME

The Newburgh Shipyards, Inc., Newburgh, N. Y., completed its shipbuilding programme for the Government with the delivery on Tuesday, December 21, of the *Storm King*, and commemorated its building programme for ships of private ownership with the delivery on Thursday, December 23, of the *Herman Frasch*.

The *Storm King* is a steel vessel of 8,434 tons dead, and the *Herman Frasch* is a twin-screw vessel of 7,304 tons.

BOARD POSTPONES SALE

The Shipping Board has decided to postpone for the present the sale of surplus material on the Pacific Coast now being advertised.

FAVORS AMERICAN SEAMEN

Chairman Benson Urges American Men for American Ships

The following letter has been released to all operators of Shipping Board ships:

"The conditions which now prevail in the ocean carrying trade have forced the United States Shipping Board as well as private shipowners to lay up a great many vessels, which automatically sets adrift a large number of seafaring men.

"As the representative of the largest ship-owning corporation in the world, the chairman of the Shipping Board feels that it is timely to invite the attention of owners and operators to the fact that the largest factors in vessel expense under the conditions which prevail at this time are repairs and fuel.

"While the policy of every prudent owner and operator is rightfully toward reduction in vessel expense, the chairman of the Shipping Board earnestly cautions all shipowners and operators not to be misled at this time into the employment of foreigners merely because it may be possible to obtain them at a lower schedule of pay than is satisfactory to American seamen.

"The true goal of American effort is to increase the efficiency of operation. The most certain means to this end is improvement in the efficiency of sea labor. This improvement in turn has been brought about by getting the American man afloat and can best be continued by keeping him afloat.

"The chairman of the Shipping Board appeals in the strongest possible terms to every right-minded and patriotic American citizen who owns, operates or has any interest whatever in American shipping to seize this opportunity to collect American seamen in American ships rather than to drive him from the sea by yielding to the temptation of minor savings in the wage scale. (Signed) W. S. BENSON, Chairman."

TO RECONDITION STEAMERS

Plans of the United States Mail Steamship Company, New York, call for placing four ex-German passenger liners, the *Amerika*, *Pocahontas*, *Antigone* and the *Princess Matoika*, into service within the next two months, according to Capt. O. W. Koester, vice-president in charge of construction and repairs. Vigorous denial was made of a report that negotiations were in progress between the steamship company and German shipyards to have the reconditioning of the liners done in German yards. Contracts for the reconditioning of the *Amerika* and the *Antigone* will be awarded shortly. The plans and specifications for the conversion of the *George Washington* into an oil burner and her reconditioning have just been completed, while the delay in the award of contracts for the *George Washington*, *Mount Vernon* and the *Agamemnon* is due to the fact that the company expects to equip all of these fast liners to burn oil for fuel, Capt. Koester stated.

BRITISH SHIPBUILDING PASSING THROUGH TRADE DECLINE

The crisis in the British shipbuilding industry, which has been anticipated for some time, now appears to have arrived. Contracts are continuing to be cancelled and no new contracts are being received. Furthermore, work is being stopped on vessels under construction and keels of cargo steamers laid down are being scrapped. The reason for this is that it does not pay to build ships under present conditions. The high cost of new tonnage and the present poor freight rates charged make it impossible for new vessels to be operated profitably. Moreover, the English Ministry of Shipping, which has recently disposed of a large number of German surrendered vessels, has caused the construction of new ships to become less. These vessels, although not sufficiently numerous to increase the mercantile marine to its normal limits, constitute tonnage ready to hand and the costs of repairing these vessels is much lower than the cost of new ones.

Many attempts have been made to discover the reasons for the falling off in trade, but all these have come back to the one thing—the high cost of production. Sir Alfred Palmer, speaking on the industrial situation in Jarrow, stated that if all would only pull together the employers in bringing and keeping their works up-to-date and in considering the welfare and happiness of their workmen, and the employees working hard and honestly without absenteeism and going easy, and if all would strive to help the Empire to pull round after the war, then no doubt trade would improve in the future. He further stated that employees must understand that it is not a question of fighting the employers and capital, but rather of fighting foreign competition.

Workmen have their demands for an increase of wages on the cost of living, but prices have commenced to fall and are expected to fall much more rapidly in the near future. If the workers would only have a little patience they will find an appreciable difference in the cost of living. The employers are also anxious to reduce the cost of living, and in resisting unreasonable wage demands are doing much towards this end.

While no settlement has been arrived at on the wage question, the workmen employed on engineering work and in engineering, boiler making and foundry departments are conceded a big concession by the employers at a conference held at York. A three-shift system was satisfactorily agreed upon, by which it is thought all the unemployed in the engineering industry will be absorbed. The first shift will consist of 43 hours, for which 47 hours will be paid; the second shift will be of 37½ hours, for which 47 hours will be paid, and the third shift will be of 37½ hours, for which 50 hours will be paid.

The shipyard joiners' strike and the strike of the Tyne and Tees tugboatmen still show no signs of settlement. Ships are being launched by the use of only one tug, and the docks are gaining experience in the handling of ships with the aid of steam launches.

Prices of shipbuilding materials have also weakened, principally due to the foreign competition. Large quantities of ship plates have been imported from the Continent and America at much lower prices than those quoted by English firms. Steel forgings are also being imported again from the Continent. These two facts alone are compelling British steel makers to reduce their scales of prices.

pany, South Shields, stated that before the war a ship was built for about £27 (approximately \$95 at the present rate of exchange) per ton, while the prices to-day range from £36 (approximately \$126) to £37 (or \$129.5) a ton.

STEAMER LAUNCHED

Messrs. William Gray & Company, Ltd., have launched at West Hartlepool, the steel screw steamer *Nirpura*, which they are building for the British Steam Navigation Company, Ltd., London. The vessel is 463 feet 6 inches overall length, with a breadth of 56 feet. The double bottom tanks are arranged for the carriage of oil cargoes and are fitted with steam-heating pipes to liquify thick oil. The cargo gear consists of fourteen derricks fitted on posts with fifteen steam winches, which exhaust into a winch condenser of the "CMEW" type.

The propelling machinery, built at the central marine engine works of the builders, consists of triple expansion engines with cylinders 28 feet 46 inches, 77 inches diameter by 54 inches stroke, and four boilers.

WORLD'S SHIPBUILDING

Drop of Only Five Percent Noted in Last Quarter

Shipbuilding throughout the world is only about 5 percent less than three months ago, although there has been a general contraction in construction, says a statement issued by Lloyd's Register of Shipping.

The total now building in the world is given as 7,179,000 gross tons, in comparison with 7,565,000 tons at the end of the third quarter of 1920. France and Holland are practically the only countries to show a gain in the amount of construction.

For the first time since the war period British shipbuilding shows a decline. The recession is only a small one, however, 3,709,000 gross tons being in hand at the end of December, compared with 3,731,000 tons at the end of last September. The decrease of 22,000 tons compares with one of 462,000 tons for American shipyards, the aggregate under way in this country at the end of 1920 being 1,310,000 tons, compared with 1,772,000 tons three months previously.

Other countries than the United States and the United Kingdom show an advance of 98,000 tons, but this is accounted for by the increase in the amount of building in France from 293,000 tons to 397,000 tons and in Holland's total of 450,000 tons compared with 424,000 tons in the previous quarter.

Fifty-one and six-tenths percent of the world's shipbuilding is now being done in Great Britain, compared with 38.1 percent at the beginning of 1920. In the same period the United States' share of the total has decreased from 37.7 percent to 18.2 percent. Today, therefore, the United Kingdom is building more than all the rest of the world combined, a position held by the United States during the period of the intensified shipbuilding campaign in this country.

RESIGNS FROM LLOYD'S

Sir Thomas L. Devitt, chairman of Lloyd's Register, is resigning from that post. Sir Thomas first became a member of the committee in 1893, was elected chairman of the subcommittees of classification in December, 1897, and chairman of Lloyd's Register in 1909, which position he has held since. Sir Thomas is resigning, owing to failing health.

SHIPBUILDING IN JAPAN

An investigation made by the Japanese authorities shows that the number of steamers in the course of construction in Japan in October was 38, the total tonnage of which was 186,190. These include 19 stock boats of 89,520 tons, 14 of which are being built at the following shipyards:

SHIPYARDS	Number of Vessels	Tonnage
Asano Shipyard	2	10,800
Harima Shipyard	3	14,600
Osaka Iron Works	2	14,600
Aizawa Shipyard	2	5,700
Kawasaki Dockyard Company	3	17,800
Mitsui Bussan Dockyard Company	..	11,600

According to an investigation made by

the Department of Communication, the total number of steamers of 20 tons and upwards was 3,090 in July, and the tonnage 3,141,729.

TO HOLD BUSINESS SESSION

The general meeting and business sessions of district managers and sales engineers will be held at the Pawling & Harnischfeger plant auditorium, Milwaukee, Wis., January 25 to 27. A general review of the past year's business will be discussed and plans for future sales in the various lines—cranes, hoists, excavating machinery and machine tools—will be outlined. Developments made in design and manufacture, also contemplated developments in connection with these lines, will be the subject of talk by the engineers and department heads. The meeting will be held under the direction of Mr. A. G. Hendricks, vice-president and general manager of the company.

PRESENT AND PRE-WAR COST OF BRITISH SHIPPING

Speaking at South Shields, Mr. Charles Rennoldson, of Chas. Rennoldson & Com-

BRITISH SHIPYARD IS WELL SUPPLIED WITH ORDERS

The keel for the first vessel to be built in the new yard of the Palmer Shipbuilding & Iron Company at Amble, England, on the Northumberland coast, has just been laid, and it is anticipated that the whole yard will be in full working condition early in the new year. This yard was laid down during the war for the building of concrete vessels, but the Palmer Company has now equipped the yard with all modern appliances for the building of smaller steel craft, which can be more advantageously built there than at their other yards at Jarrow or Hebburn. They have several orders in hand for such vessels, and the first ship laid down is a twin-screw ferry steamer.

The Palmer Company is well supplied with orders and can keep its Tyne yard going for a considerable time. The company has recently contracted for the conversion of the *Titan*, owned by the Cie Generale Transatlantique, from a cargo boat to an oil carrier. Two other large oil carriers are in dock undergoing extensive overhaul.

FOREIGN ACTIVITIES

New Ships and Repairs

The oil tanker, *San Fernando*, owned by the Eagle Transport Company, is undergoing repairs at the yards of Messrs. Swan Hunter & Wigham Richardson. This ship has a carrying capacity of 13,200 tons and is 539 feet long. The American ship, *Siboney*, which was damaged through going ashore at the Spanish coast, is also being repaired. She is of 7,653 tons and is 423 feet long.

The Middle Docks & Engineering Company has for repairs the steamer *Sygn* of 3,881 tons.

Sir W. G. Armstrong-Whitworth Company, Ltd. has in hand the building of a motor tank ship of about 6,500 tons, while Denny & Brothers, Dumbarton, Scotland, has just contracted to build a 10,000 ton motor tank ship for the British Tanker Company, Ltd.

Vickers, Ltd., of Barrow, has under construction four tankers for Tankers, Ltd.

Harland & Wolff, Ltd., one of the largest shipbuilding and repairing concerns in Great Britain is opening a ship repairing and engineering branch on the River Thames, London. This firm has concluded a contract with the Port of London Authority to take over its engineering repairs and construction work, and has agreed to construct buildings of a prominent character of not less than £300,000 (approximately \$10,500,000 at the prevailing rate of exchange) in value as well as two slip ways for ship repairing and possibly shipbuilding. It is understood that the firm will devote the greater part of its attention to the overhauling and repairing of vessels trading with the port of London.

The sailing bark *Portugal*, owned by the Empreza Portuense de Transportes Maritimos, Ltd., is at present in the Clyde being converted into an auxiliary by Messrs. William Beardmore & Company, Ltd., Coatbridge. The vessel is of steel and has a deadweight carrying capacity of 2,000 tons. When completed, it is proposed that the ship will trade mostly between Portugal and the States.

Two new motor coasting vessels are now in course of construction at the yards of the London-Montrose Shipbuilding & Repair Company, Montrose, to the order of A. Besse, Esq., Aden.

Launchings

Steamer *Eastney* by the Northumberland Shipbuilding Company, Ltd., at Howdon-on-Tyne for the Ronney Steamship Company, Ltd. Length 375 feet, 8,000 tons deadweight.

Steamer *Alu Mendia* by the Ropner Shipbuilding & Repair Company, Ltd., Stockton-on-Tees, for Sota & Aznar, Bilbao, Spain; length 310 feet.

By the Northumberland Shipbuilding Company, Ltd., steamer *Adamello* of 9,250 tons deadweight and the steamer *San Michele* of 8,100 tons deadweight for Messrs. Comorsio Veneziano di Armamento e, Navigaziano, Venice, Italy.

Dutch minelayer, *Van Meerlant*, by the Werf Gusto, Firma A. F. Smulders of Schiedam, Holland, for the Royal Dutch Navy, the first of two such minelayers in erection at their yards.

Steel screw shelter deck steamer *Aterxerendi*, 340 feet long, by the Ropner Shipbuilding & Repairing Company, Ltd., Stockton-on-Tees, for Messrs. Sota & Aznar, Bilbao, Spain.

The Cunard liner *Samaria*, the largest ship ever built on the Mersey, by Messrs. Campbell-Laird & Company, Ltd., Birkenhead, England; 623 feet long, 21,000 tons.

Tonnage Output on Clyde

Twenty-five vessels, aggregating 47,837 tons, were launched from shipbuilding yards on the Clyde in November, which brought the total production for the year up to 540,214 tons. Although the month's figures are below November last year, the output exceeds that of the eleven months of 1919 by 36,559 tons.

New Passenger Liner

The fastest Diesel-drive passenger liner in the world will be constructed for the Swedish-American Line in Gothenburg, Sweden, and will be placed in service some time in 1922. The vessel will be 590 feet long, with a beam of 72 feet, and will have accommodations for about 1,500 passengers, including first, second and third class. To attain a speed of 18 knots, machinery of 16,000 indicated horsepower will be installed.

The Situation in England

Sir George Hunt, chairman of Swan, Hunter & Wigham Richardson, speaking at a meeting at Wallsend, recently, expressed the opinion that a period of slackness was before the shipbuilding industry in Great Britain. He stated that the depression might not come suddenly owing to the large amount of work still on hand, but for every new order now being placed shipowners were trying to cancel two others. The reason, he said, was the appalling cost of building new tonnage and unless that was reduced, the shipbuilding industry could not reach its former high standard.

TRANSFERS OF VESSELS

Kentucky, steam screw, 43 tons, Daniel R. Ludwig to Daniel Frank Ludwig.

Kermite, steam screw, 22 tons, American Ship & Commerce Corp., to Kermit Roosevelt.

Monk Girls, barge, 45 tons, W. F. & R. Boat, Inc., to Thomas Monk, Jr.

Norfolk, barge, 164 tons, Philip Rice, owning 2/3, Edward S. Johnson, 1/6th.

C. H. Marchal, steam screw, 60 tons, Charles R. Stewart and William W. Gearhart to Staten Island Ship Building Co.

Clermont, steam paddle, 1,174 tons, estate of George W. Perkins to Commission of the Palisade Interstate Park, \$553,827.

Onteora, steam paddle, 771 tons, estate of George W. Perkins to Commission of the Palisade Interstate Park.

Cockatoo, steam screw, 101 tons, U. S. Shipping Board to Goodwin-Gallagher Sand & Gravel Corp.

Catherine Moran, steam screw, 80 tons, Moran Towing Line to Alpha Towing & Transportation Co.

Jim Hughes, barge, 492 tons, W. F. & R. R. Boat Builders, Inc., to James Hughes, Jr.

John T. Donahue, steam screw, 140 tons, Great Northern Paper Co. to Wm. C. Bickel and Lester A. Forsyth, \$20,000.

Rachel Stevens, schooner, 1,032 tons, Minnie Goodrich, 1-64, to Fields Pendleton.

William H. Gallison, steam screw, 29 tons, U. S. Marshal to John J. Ascher, \$7,300.

Ditto, John J. Ascher to Daly Towing Line, Inc.

NEW INCORPORATIONS

Colonial Steamship Corp., Manhattan, \$25,000; F. J. Kandt, J. G. Kresge, F. A. Haight, 50 Broad street.

Danzig Line, Manhattan, navigation, \$5,000; L. W. Simmons, G. N. Richards A. F. Egelhoff; no address.

Commonwealth Commerce Co., Manhattan, steamship brokerage, \$10,000; R. Souffront, E. T. Eustis, G. D. Carrington, 120 West 11th street.

Portuguese State Maritime Corp., Manhattan, navigation, \$5,000; L. W. Simmons, G. H. N. Richard. A. F. Egelhoff; no address given.

Victor Wilusz International Steamship Ticket Agency, Jersey City, \$100,000; Alexander B. Ceichuch, R. W. Dluswieswiski Victor Wilusz, Jersey City.

Seven Seas Corp., \$1,000,000; Thomas P. McKee, Elmer F. Powell, Newark, N. J.; Frederick C. Bruckner, New York.

Robinson & Stevens, Inc., Central Park, N. Y., \$10,000; contracting and stevedoring; J. W. Robinson, Edwin A. Stevens, Maud A. Robinson, Central Park.

Wordsen Corp., Delaware, \$100,000; T. L. Croteau, M. A. Bruce, S. E. Dill, Wilmington.

McEvoy Mechanical Device Corp., Manhattan, machinists and shipbuilders, \$5,000; J. A. Trimble, R. A. Barton, H. D. O'Hara, 524 West 145th street.

Naval Stores Corp. of New York, Manhattan, general merchandise, \$10,000; D. L. Crowley, P. S. Goldrich, S. W. Kroll, 116 Nassau street.

McCarren Towing Line, Newark, \$100,000; Daniel McCarren, Daniel McCarren, Jr., Lida A. McCarren, Newark.

Robert Rook, Camden, ship chandlers, \$125,000; Robert S. Rook, Edward West, Orlando M. Bowen, Camden.

Dur-Hut Transportation Comapny, boats \$450,000; T. L. Croteau, M. A. Bruce, S. E. Dill, Wilmington.

G. M. Luix Steamship Co., agents, \$100,000; Antonio B. Camara, Oscar M. Malleeler, James J. Suludes, New York.

Doscher Transportation Corp., Manhattan, stevedore, \$10,000; C. McLennan, M. E. Wood, H. Doscher, 117 Greenwich street.

McCormack Stevedoring Co., Manhattan, \$10,000; R. W. Barker, H. Hampel, T. F. Fay, 438 Third street, Brooklyn.

North American Lloyd, Wilmington, Del., Charles B. Bishop, A. M. Fox, R. H. Ochletree, Wilmington.

Seacraft Corp. of California, Los Angeles, \$250,000; E. A. Featherstone, Dustin Farnum, H. E. Roach, R. Thomas, Harry C. Keefe, J. A. Talbot and Marco H. Hellman.

Great Lakes & Atlantic Transit Co., Inc., Wilmington, Del. To build, own and operate boats; cap., \$15,000,000.

Changed from North American Lloyd, Inc., to the Amalgamated Maritime Corporation of America, Wilmington, Del.

F. W. Freeborn Engineering Corporation, Wilmington, Del. A general engineering business; cap., \$500,000.

MacLebee Electric Co., Wilmington, Del., Manufacture and installation of electrical motors and devices; cap., \$300,000.

Robson Raft and Lifeboat Corporation, Boston, \$200,000; Robert Dobson, James R. Glassford and Everett W. Flint, Boston.

Consolidated Fuel and Transportation Co., \$5,000,000; T. L. Croteau, M. A. Bruce, S. E. Dill, Wilmington.

Dur-Hut Transportation Co., Wilmington, Del.; to own and operate boats; \$450,000.

Bowe-Mortons Stores, Brooklyn, N. Y., wharfage and warehousing, \$70,000; H. B. Gayley, H. J. Mayer, H. M. Samson 149 Broadway, N. Y.

J. V. Petrie & Son, Manhattan, shipbuilding \$10,000; A. A. Fox, S. V. and J. V. Petrie, 178 Prospect Park West, Brooklyn.

DESIGNATION

Charbonneau, Rajola & Co., Del., ocean carriers, \$100,000; rep., A. Charbonneau, 52 Broadway.

T. A. Scott Co., Conn., Marine Construction and Transportation, \$150,000; rep., G. V. Reilly, 65 Cedar street.

Collieries and Commerce Corporation, Va., ship coal, \$100,000; rep., T. K. Schmuck, 27 William street, Manhattan.

Auditors Steamship Line, Delaware; 10,000 shares common stock, no par value. Rep., J. G. Stockham, 2 Stone street, Manhattan.

Marine Construction News of the Month

Ship Contracts—New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Tankers, Victoria, B. C.—The Harbor Marine Company is reported to be negotiating for the construction of four 8,000-ton steel tank steamers for Peruvian interests.

Active Production, Mobile, Ala.—All six ways of the Chickasaw Shipbuilding & Car Company's plant, are occupied with hulls under course of construction.

Pleasure Boat, Mobile, Ala.—James A. Campbell, will build a pleasure boat, 110 feet long, 22 feet wide, and to cost \$30,000, for the Daphne Boat Company of Mobile.

Lake Passenger Ship, Cleveland, Ohio.—The Cleveland & Buffalo Steamship Company, operating passenger ships between Cleveland and Buffalo, is awaiting a more favorable time to build a new vessel to replace the City of Buffalo.

Repairing Vessels, Pensacola, Fla.—The Pensacola Shipbuilding Company has been awarded contracts for repairing and rebuilding three vessels recently damaged by fire at Galveston, Tex., aggregating an expenditure of \$1,000,000.

Oil Tankers, Prince Rupert, B. C.—The Prince Rupert Dry Dock and Engineering Company, is reported to have received orders from the French Government for five steel oil tankers of about 6,500 tons each.

Pilot Station Boat, Baltimore, Md.—A new station boat for service at Cape Henry is to be built for the Maryland Pilots Association. Bids are under consideration at the Pilot Office, foot of Broadway.

Dreadnaught to Be Converted Into Liner.—The Italian Dreadnaught Caracciola has been sold to the Navigazione Italiana to be transformed into a transatlantic liner, according to reports from London.

Barges to be Converted, Leith, Scot.—Henry Robb, Ltd., has received an order from an English firm for the conversion of five barges, each 240 feet long, into oil tankers, with a carrying capacity of from 1,000 to 1,500 barrels.

Steamer, Baltimore, Md.—The Baltimore Steam Packet Company, is in the market for a combination freight and passenger-carrying steamer to be called the Maryland. Plans and specifications have already been prepared, and are in the hands of several shipbuilders for quotations.

To Be Made Fruit Carriers, Philadelphia, Pa.—The Warden, Perry, Whipple, Truxton and Stewart, torpedo boat destroyers, sold as junk by the Navy Department, are being converted into fruit carriers by the Clinton Company of Philadelphia.

Vessel to be Repaired.—The contract for repairing the ship Rhine, which was seriously damaged several months ago by fire, has not been awarded, although bids were submitted by several Boston and New York repair concerns. The cost of repairs is estimated at about \$100,000.

To Build and Operate Tankers, Baltimore, Md.—Interests in control of the Baltimore Dry Docks and Shipbuilding Company are said to have formed a \$2,000,000 corporation for the operation of a fleet of four tankers which the company is to build at its plant for its own account.

Reconditioning Steamer, Oakland, Cal.—The Moore Shipbuilding Company was the successful bidder for the contract for reconditioning the steamer Enterprise. The ship is to be practically rebuilt, and a new engine purchased from the Shipping Board will be installed. The work will require several months, and will cost \$186,000.

Auto Ferry Planned, San Francisco, Cal.—Plans have been drawn up for the construction of a double-decked ferry for the transportation of automobiles between San Francisco and Oakland, Cal. The craft will be equipped with Diesel electric motors, and will accommodate twenty-five automobiles.

Schooner Repairs, Oakland, Cal.—The Moore Shipyards have commenced repairs on the schooner Santa Monica, owned by John Hanify, San Francisco, which struck a bar recently. The schooner Fred Baxter, of the J. H. Baxter Company, is also at the yards undergoing a general overhauling.

Barge, Pittsburgh, Cal.—A contract has been let to Lanteri's Shipyards, for the construction of a water barge for the California-Hawaiian Sugar Company. The vessel will be 206 feet long, 52 feet beam and 14 feet deep, and will be used for carrying water between the river above Antioch and the refinery at Crockett.

Motorship Sold, Seattle, Wash.—The wooden motorship Kirketind was purchased by the Donovan Steamship Company, San Francisco, Cal., at a Federal Court sale at Seattle recently. The vessel was built this year at a cost of \$400,000, but the sale price, it is reported, was only \$153,000. The purchasers will put the vessel in the lumber carrying trade.

Hulls to be Converted into Barges, Portland, Ore.—A project is under way to convert a number of Shipping Board hulls into barges, and to operate a line of barges and tugs from the Columbia River and Puget Sound to New Orleans and the Atlantic Coast, according to William Shumm, traffic manager for the Pacific Coast Shippers' Association.

Converting Freighters into Tankers, Baltimore, Md.—The Globe Shipbuilding Company, is converting the freighters Manatwny, Cathahoula, Castana, Carraouille and Casimir into tankers for private interests, which recently bought the vessels from the Shipping Board. The vessels are now having longitudinal bulkheads installed and the necessary angles and plates placed to enable them to carry crude oil.

Barges, Linnton, Ore.—Supple & Martin, who are operating the former shipyard of the Columbia Engineering Works, have been awarded a contract for the building of four 600-ton barges for the Crown-Willamette Paper Company. The barges will be of the spoon-bow variety, and will be used by the paper company to carry fuel from the lumber mills of the lower Willamette River to their plant at Camas, Wash.

British Contracts, South Shields, England.—The Smith's Dock Company, has secured the contract for converting the steamer Vaarili, of Bergen, from a cargo boat into an oil tanker. This boat was built in the United States in 1916, and is of 5,828 tons gross register. They have also on hand the oil tanker Strombus, belonging to the Anglo-Saxon Petroleum Company. This vessel was the last to be torpedoed and was heavily damaged her stern being completely blown away.

Additions to Olympic, Belfast, Ire.—Following her arrival at Southampton early in January, the

steamship Olympic will be sent to the yard of Harland & Wolff, to have her oil bunkerage capacity increased. Oil storage tanks of 910 tons capacity will be installed in hold No. 1, and of 1,577 tons in hold No. 3, which will bring the ship's total bunkerage capacity up to 7,555 tons, or more than enough fuel for a round voyage. Her present capacity is 5,068 tons.

Plan to Build Submarines, France.—Plans of the French naval experts call for the construction of at least 100 high powered submarines. Officials of France are in accord regarding the superior value of the submarine over cruisers and battleships in the event of war, and while not intending to abandon entirely the building of new battleships, France will concentrate her efforts on building a submarine fleet which will figure her as a world naval power.

Reconditioning Steamer, Brooklyn, N. Y.—The Shipping Board has awarded the contract for overhauling and refitting the steamship Invincible to the Tebo Yacht Basin Company. The contract calls for general voyage repairs and the replacement of the war emergency type of geared turbine with the electric drive; all work to be completed by Feb. 11, and to cost \$82,474. The Invincible, which is a sister ship of the Eclipse, is the second of the Shipping Board fleet to have the electric drive installed.

Ferryboats, San Francisco, Cal.—Three ferryboats of the type used by the Key Route, San Francisco Bay, will be constructed by the Six-Minute Ferry Company, recently granted privileges in San Francisco and Oakland, Cal., and is capitalized at \$3,000,000. Articles of incorporation have been filed by the Golden Gate Ferry Company, which plans to operate vessels between San Francisco and Sausalito, for which service two ferryboats will probably also be constructed.

Shipbuilding Activities at Beaumont, Tex.—The Beaumont Shipbuilding & Dry Dock Company, which recently enlarged its plant and made provisions for repairing steel as well as wooden vessels, is engaged in repair and construction work. A number of barges and other small craft are being built for private account. It is probable that the company will be called upon to convert a number of Ferris type wooden ships into oil barges, and this work will keep the plant busy for many months.

Tankers, Quincy, Mass.—The first of five bulk oil carriers, totaling nearly 60,000 deadweight tons, is soon to be launched at the Fore River plant of the Bethlehem Shipbuilding Corporation, Ltd. Two of these vessels, each of 12,600 tons, will be delivered to the Standard Transportation Company, of New York; the third, which is of the same tonnage, is for the Atlantic, Gulf & West Indies Steamship Company, while the two others of 10,600 tons each will become part of the Sinclair Oil Company's fleet.

New Ferryboat, Hudson, N. Y.—The Hudson and Athens Ferry Company, is to have a new ferryboat on the run next spring. The boat, which will replace the George H. Power, will be 115 feet long and 44 feet wide. It will be a double-ended propeller, with two decks, the main deck being used entirely for traffic. The hull will be built at Washburn, Wis., and will be brought across the lakes to Oswego, N. Y., where the engines, built by the Ingersoll-Rand Company, will be installed. It is hoped to have the boat in service on Memorial Day, 1921.

Fruit Steamers, Newburgh, N. Y.—The Choluteca, one of three similar vessels for the Cuyamel Fruit Company, has been launched at

the Newburgh Shipyards, Inc.—The vessel is especially constructed for the carriage of fruit and passengers from Central American countries. It is designed to carry a deadweight of 2,100 tons on a draft of 17 feet, and to have a cargo space of about 140,000 cubic feet. The vessel has accommodations for a maximum of 32 passengers, and is built to the highest class of Lloyd's Register and in accordance with requirements of the United States Steamboat Inspection Service.

Tankers, Japan.—It is reported that the Japanese Diet has appropriated 13,500,000 yen for the construction of tankers. Orders have been placed with the Kawasaki Dock Yard, the Yokohama Dockyard, and the Osaka Iron Works for several tankers each of 11,000 tons, and having a carrying capacity of 9,000 tons of oil.

Tankers, Wilmington, N. C.—The George A. Fuller Company Carolina Shipyard, having completed its contract with the Shipping Board, with the delivery recently of the 9,600-ton steamer Syros, is now engaged solely in the construction of oil tankers, the first of which will be delivered to British owners during January.

Transport, Tacoma, Wash.—A contract for the construction of a 10,000-ton transport has been awarded to the Todd Shipyards Corporation, and it will be built within the next twenty months at the Tacoma, yards of the corporation at a cost of \$3,935,000. The vessel will be 484 feet long, and have a beam of 64 feet. It is understood that her speed will be about 16 knots and that she will be equipped with oil-fired boilers and turbine engines. This transport will be used to replace some of the more antiquated troop carriers that are being retired from the service of the Navy.

SHIPYARDS AND DRY DOCKS

Power Boats, Etc., Baltimore, Md.—The Ericson Marine & Air Craft, Ltd., will establish a plant for the manufacture of air craft and power boats.

Shipyard Addition, Alameda, Cal.—The Bethlehem Shipbuilding Corporation, Ltd., has completed plans for the erection of a one-story machine shop addition to cost about \$30,000.

New Pier, College Point, L. I., N. Y.—The College Point Dry Dock & Repair Co. has let a contract for the construction of a new pier to the Robins-Ripley Co., 50 Church Street, New York.

New Boat Building Company, Memphis, Tenn.—F. O. Fletcher is interested in establishing a company for the manufacture of river boats. F. T. Rurrit and E. T. Hutchings, Louisville, Ky., are engineers.

Dry Docks—Favorable progress is reported in the construction of an 8,000-ton floating dry dock for the Federal Shipbuilding Company, Kearney, N. J., and a similar dock of 10,000 tons for the Sun Shipbuilding Company at Chester, Pa. The dry docks are of William T. Donnelly design.

Repair Rates Reduced, New York—The reduction of repair rates of both harbor and ocean-going vessels is announced by the Staten Island Shipbuilding Company. Other local shipyards have also reduced the cost of repairs, averaging from 6 to 10 percent.

Plant Being Dismantled, Providence, R. I.—The plant of the Lord Dry Dock Company, which was erected during the war to build Ferris type wooden vessels, is being dismantled and the equipment shipped to the company's shipyard at Weehawken, N. J.

Shipbuilding Machinery, North Tonawanda, N. Y.—The Disappearing Propeller Boat Corporation, Robinson Street, is arranging for the immediate installation of machinery at its new plant, at which it expects to begin operations in December. Neil Wilson is manager.

Shipyard Addition, New Orleans, La.—The Marine Iron Works, 1012 Magazine Street, is planning the construction of a new one-story machine and forge shop 75 by 115 feet, to cost about \$75,000. A department for boiler work will be installed.

Enlarging Plant, Milwaukee, Wis.—The Nordberg Manufacturing Company is completing additions to its plant at Chicago and Oklahoma Avenues, which will cost about \$150,000, and provide capacity for building of large Diesel-type engine units. The machine shop has been enlarged 180 x 200 feet.

Shipbuilding Supplies—Bids for the purchase of \$15,000,000 worth of surplus material, located in the yards of the Shipping Board on the Pacific Coast, will be asked by the Shipping Board, it is announced by Admiral Benson. Some of the yard sites will also be sold after the material has been disposed of, it is reported.

Repair Plant, Green Bay, Wis.—C. Hartmann, formerly of the Hartmann-Greiling Company, is head of a concern which is organizing a drydock and ship repair plant at Green Bay. Work on the drydock will be completed next year. A power house, and stock of material, however, is available for repair work.

Shipyard to Be Sold, Jacksonville, Fla.—An agreement has been reached whereby the Bentley Shipyard, now owned by the city of Jacksonville, Fla., will be sold to the Merrill Steven Corporation, for \$315,150, to be used for putting an 8,000-ton dry dock in operation. A repair plant will be located on the property.

Ships and Dry Docks Burned, New Orleans, La.—Three vessels of the Shipping Board were destroyed and seven others damaged by a fire which swept the Jahncke Dry Docks, on December 16. Approximately 1,200 feet of wharfage was also destroyed, the property loss being estimated at \$3,500,000.

New Shipyard, Europe—According to information received from the American Legation at Bucharest, a Jugo-Slav Syndicate, under Government supervision, intends to construct a large yard for building and repairing ships. The syndicate planning to undertake this project controls practically all the Jugo-Slav ships on the Danube and Save Rivers.

Shipyard Ready for Operation, Washburn, Wis.—The Anchor Shipbuilding Company has placed its new shipyard and dock in operation. It will build wooden vessels exclusively for the present. New equipment is being installed, including the construction of two oil-burning furnaces for plate and angle work. Three additional slips will be built during the winter. Robert Curr is general manager.

Shipyard for Revere, Mass.—The Shawmut Marine Company, 85 Devonshire street, Boston, Mass., expects next spring to develop a modern pleasure and commercial vessel (up to 200 feet) building and repair plant on its 900-acre property at Revere Mass. The company has changed its name from Britt Bros. Corporation, and has added several well-known business and professional men to its directorate.

Dominion Shipyard to Resume, Toronto, Can.—The plant of the Dominion Shipbuilding Company, which has been idle since the company went into liquidation several weeks ago, will be reopened, and the work of completing the two 4,000-ton ships, which were under construction for the Dominion Government, will be taken over by the Collingwood Shipbuilding Company, and will probably be finished by next summer.

New Purchasing Agent, New York—The Smith-Eiseman Corporation of America, 217 Broadway, iron, steel and machinery exporter dealing largely with French shipyards, has been appointed exclusive purchasing agent for the United States and Canada by the Chantier et Ateliers de St. Nazaire, Penhoet, of Paris. It will also be American selling agent for the company.

New Boat Building Company, Los Angeles, Cal.—The Searcraft Corporation of California was recently incorporated with a capital of \$250,000, and F. A. Featherstone as president and Marco Hellman as treasurer. The company has acquired the plant of the Marine Equipment Company at Wilmington, Cal., which it will improve with new machine and metal worker shops and shipways, it will specialize in the building of pleasure craft.

Repair Plant, Chattanooga, Tenn.—The Bible Sand Company, Richard Hardy, president, will construct ways costing \$25,000, of the side haul type, with four cradles, each 35 by 25 feet, to run on tracks extending 100 feet in the water and 150 feet up the bank. The land foundations will be of concrete and the river foundations of broken stone. The company will build and repair boats, barges, etc., of a maximum size of 158 feet long, 32 feet wide and 1-foot draft. N. W. Bowden and H. B. Springer are the engineers.

Plant to be Enlarged, Esquimalt, B. C.—Yarrows, Ltd., the Canadian shipbuilding subsidiary of Yarrows & Company, of Scotstoun, Scotland, is planning extensive expansion of its plant. William W. Marriner, works manager of the English company, was in Victoria recently to look over the plant in order to be able to make a report on what extensions are required, having been greatly impressed with the large amount of work done by the plant and the vast possibilities of the Pacific Coast.

Plant Resumes Operation, Seattle, Wash.—The Elliott Bay Marine Construction Company, having leased the south half of the Duwamish Waterway plant of the Elliott Bay Shipbuilding Company, with option of purchase, has resumed operations as a repair plant. A new marine railway with three tracks, capable of handling vessels up to 800 tons, has been built in No. 1 slip. Two smaller railways, each of 150 tons, are being laid in No. 2 slip; No. 4 slip will have a marine railway for storing vessels, and No. 3 will be used for other purposes.

Drydock, Shops, Etc., Perth Amboy, N. J.—The Perth Amboy Dry Dock Company will soon install a new 10,000-ton electrically operated drydock at its plant at the foot of Broad Street. It will be 462 feet long and 117 feet wide, and will be capable of accommodating vessels up to 500 feet in length. Additional buildings to provide for extra equipment necessary for the repair and construction of vessels will include a one-story boiler, plate and angle shop, 70 by 108 feet; concrete and steel machine shop, 70 by 100 feet, and a forge shop 70 by 90 feet. It is expected that about 1500 men will be employed.

Dry Dock, Norfolk, Va.—The fourth section of the floating dry dock of the Norfolk Shipbuilding & Dry Dock Corporation, was launched recently, at the company's plant at Argyle Avenue, Brambleton. This section is 60 feet long by 80 feet wide, 11 feet deep to the deck, and 32 feet deep to the top of the wings, and will be operated by six centrifugal pumps of 2,600 gallons per minute capacity, which in turn will be operated by six electric motors of 20 horsepower each. This section will have a lifting capacity of 1,000 deadweight tons, and will accommodate a vessel of 5,000 gross tons. It will be connected with the present three sections in two weeks. The cost of construction of this section is estimated at \$125,000.

Enlarging Plant, Seattle, Wash.—Consummation of a deal whereby the Barde Steel Products Corporation of New York will acquire the Ames Dry Dock & Shipbuilding Company's yard for a consideration of \$1,250,000 is expected in the near future. While the transfer of the property has not been completed, it is reported that a full agreement has been reached between the two parties. The Ames plant is ideally located in Seattle for a terminal, and it is known that the plans of the new purchaser call for the active operation of two of the four building ways in the Seattle yard. During the war the Ames yard turned out a considerable number of the 8,800 deadweight ton cargo carriers of the West Inskip type.

Big Repair Plant, Philadelphia, Pa.—G. H. S. Rollason, vice-president of the Dry Docks & Ship Repairs Corporation, announces that his company has secured about 36 acres of land in Camden, N. J., with 1,020 feet of water front and proposes to build a modern drydock and repair plant. Three piers 500 feet in length, two of which can later be extended, two of which can later be extended to 600 feet in length and one to 900 feet in length when conditions in the port warrant such extension, are to be built, together with one dry dock of 10,000 tons capacity, one of 6,000 tons capacity, and one marine railway of 4,000 tons capacity. A complete equipment of buildings and machinery, a set of ways for

wood and steel river and harbor barge construction, one or two floating machine shops, derrick barges and a floating welding plant, are also to be provided. The company's offices are at 1214 Real Estate Trust Building, Philadelphia.

PORT IMPROVEMENTS

Docks, Etc., Palmetto, Fla.—The city, W. E. Mann, clerk, will proceed with the construction of the new municipal dock and piling protection.

Wharves, Beaumont, Tex.—The city will soon vote on \$500,000 bonds to improve the wharves. Address the Mayor.

Sea Wall, Hull, Mass.—The town let contract for building a reinforced concrete sea wall on Grover avenue to B. Weston, Allerton, to cost about \$15,000.

Dredging, Tampa, Fla.—W. C. Clarkson plans to dredge slip 1,450 feet long, 200 feet wide and 16 feet deep, involving 320,000 cubic yards of excavation, and to cost about \$75,000.

Wharf, West Norfolk, Va.—Hastings Brothers, Seaboard Bank Building, will rebuild the wharf which was recently burned, and costing about \$40,000.

Canal, New Orleans, La.—The Grand Isle Navigation Commissioners, Grand Isle, La., propose to construct a canal for the navigation of boats from New Orleans to other points.

Concrete Dock and Shed, Manchester, Tex.—A concrete dock and shed, to cost about \$300,000, will be built on the Houston Ship Channel. Money is available for the work.

Terminals, Charleston, S. C.—The Charleston Port Terminals, Inc., has been organized with a capital of \$100,000 by J. Ross Hanahan and Joseph M. Whitsitt. They have leased terminals, including dock, headhouse and warehouse.

Piers, Equipment, Etc., Jacksonville, Fla.—The city plans to build a pier with warehouses, loading and discharging facilities, railroad tracks, cranes, engine, etc., in the St. Johns River, to cost about \$1,000,000.

Bulkhead, New York—The Lehigh Valley Railroad, 143 Liberty Street, let contract for making the necessary repairs to the bulkheads along the North River to Barney Ahlers, 110 West 40th Street, New York, at a cost of about \$100,000.

Japanese Harbor Improvements, Yokohama, Japan—The harbor officials will spend about \$7,000,000 for improving that port. Plans are also being prepared for improving and constructing new piers at Kobe, Shimonoseki and Kuratsu.

Salvage Equipment, San Francisco, Cal.—Four 1,000 horse-power tugs now nearing completion at the Main Iron Works have been equipped with heavy derricks and other gear for salvage work, for the Shipowners' & Merchants' Tug Boat Company.

Wharf, New Orleans, La.—The Dock Board is having plans and specifications made, and will soon receive bids for the building of a 1,200-foot creosoted timber wharf to replace one recently destroyed by fire at an estimated loss of \$250,000. H. N. Gallagher, foot of Canal street, is chief engineer.

Absecon Inlet—Recommendation for \$105,000 in the rivers and harbors bill, now being prepared, is being advocated for Absecon Inlet, Atlantic City, N. J., by a board of engineers. Bulkheading for the municipal ship terminal was completed this week, and work on the wharves will begin at once.

Deepening Harbor, Miami, Fla.—Deepening of the harbor of Miami to 25 feet, in order that larger vessels may touch at that port, will be asked of Congress. The present depth of the harbor is 20 feet, but increased business at the port, it is stated, calls for facilities for larger vessels.

Marine Terminal, Havana, Cuba.—It is reported that the Appalachian Corporation, New Orleans, La., will construct a warehouse and marine terminal at Havana. Plans have been made for the acquisition of a tract of waterfront property on Havana Bay, with sufficient wharf frontage for about 12 ships.

Dredging, Port Tampa, Fla.—The Atlantic Coast Line Railway Company, Atlantic Coast Line building, Wilmington, N. C., plans to dredge the channel at Port Tampa to a depth of 27 feet, involving 50,000 cubic yards of rock and 37,120 cubic yards of earth excavation. J. E. Wolloughby is chief engineer.

Steel Crane Runway for Pier, Worcester, Mass.—The Morgan Construction Company, 15 Belmont Street, let contract for building a steel crane runway 250 feet long and 60 feet wide on concrete piers at their Crescent Street plant, to the Eastern Bridge and Structural Company, 88 Crescent Street; about \$25,000.

\$1,000,000 Shipping Terminals, Memphis, Tenn.—According to the Chamber of Commerce, the Federal Government and the city of Memphis, Tenn., will spend a total of \$1,000,000 in the construction of shipping terminals in the vicinity of Harahan Bridge, which spans the Mississippi at Memphis, making the city one of the great inland ports of the country.

Wharves, Lords Cove, N. B.—The Department of Public Works, Ottawa, Canada, has let a contract for the building of a wharf at Deer Island, to F. L. Boone, South Devon, to cost about \$20,000. A contract for building a wharf at Owen Sound, Ont., was also let to E. Conroy, Peterboro, amounting to about \$18,000, on a cost plus percentage basis.

Pier, Breakwater, Etc., Missoula, Mont.—The Missoula Light & Water Company, Masonic Temple Building, plans building of a concrete and steel pier, 150 foot breakwater, etc., involving the expenditure of about \$20,000. J. C. Philips, secretary, Power Engineering Company, 621 Metropolitan Life Building, Minneapolis, Minn., engineers.

Terminals, Equipment, Etc., New Orleans, La.—More than one-third of a mile of additional waterfront facilities, equipped with the most modern loading and unloading devices, will soon be turned over by the United States Government to the port of New Orleans, La., according to W. O. Hudson, president of the Board of Commissioners of the port.

Piers, New York—The Department of Public Markets, Municipal building, plans to build a 1,000-foot pier at Thirty-ninth street, Brooklyn, to cost about \$1,500,000; a 1,000-foot pier at 150th street and Harlem River, Bronx, to cost about \$1,500,000, and four 1,000-foot piers on Gansevoort and West Washington streets, to cost about \$5,000,000 all to be used as markets.

Wharves, Charleston, S. C.—Work has been started on the waterfront property of H. F. Barkerding and his associates, adjacent to the Clyde Liner terminals on the north. Plans include the building of new wharves, which will extend to the same head lines as the Clyde terminals. The slip will be dredged and generally improved along with the other work, which is in charge of the Jefferson Construction Company.

Terminal Contract Award Held Up, Weehawken, N. J.—Although the plans have been completed for the construction of a \$30,000,000 freight terminal at Weehawken, N. J., the Cunard Line is holding up the award of contracts until the prices of material and labor are lowered. It is probable, however, that work on this project will be started next spring or summer. Dredging of the waterfront to a depth of about 35 feet is now in progress.

Port Terminal, Wilmington, Del.—The development of the Lobdell Tract along the Christiana as a part terminal will be started next spring. Preliminary work has been completed on the harbor plans, and from now on the concrete building of a bulkhead, storage houses and rail lines will be pushed as rapidly as it is possible for the engineers to get out drawings. The City Council has appropriated \$2,000,000 for this work.

Deepening Channel, Locks, Etc.—Seattle citizens advocating the improvements to Lake Washington Canal have placed their suggestions before Col. Edward H. Schulz, of the United States Engineers. They include dredging and deepening of the channels to Lake Washington, and to Puget Sound, improvements to the approaches to the locks, and the addition of a larger lock, which would make the waterway capable of accommodating the largest battleships as well as merchant marine vessels.

Dredging, Etc., North Portland, Ore.—H. L. Gilbert has completed his survey of the harbor, ordered by the Port of Portland Commission to determine the advisability of opening that waterway to navigation, and recommends a channel 300 feet wide and 25 to 30 feet deep from the mouth of the Willamette River to the upper end of Monarch Mill Dock; completion of a dam across the upper end of the slough, to create a still water basin, and donation of a site for a public dock by interests benefited by the improvements.

New Piers, Philadelphia, Pa.—George F. Sproul, director of wharves, docks and ferries, has made public the details of plans for the construction of a new city pier at Chestnut Street on the site of the old pier to cost about \$500,000. It will be a double deck steel and concrete structure 80 by 550 feet, extending out to the pierhead line. The first deck will be equipped with accommodations for river steamboats. The second deck will be used as offices for the Department of Wharves, Docks and Ferries thus saving the city the annual rental of \$12,900 now paid to the Philadelphia Bourse. The department also took over the old pier property north of Market Street extending to the new Cherry Street municipal pier. Those structures will be torn out and replaced by two modern combination piers equipped for use either as trans-Atlantic terminals or for coastwise and river traffic.

Terminal, Etc., San Francisco, Cal.—The Board of State Harbor Commissioners will ask for an appropriation from Congress for the dredging of the Islais Creek India Basin district as part of their plans for the development of this district into a first class ocean terminal, and industrial district. A series of solid-fill piers, contemplated, will be 1060 feet in width and vary in length from 1060 to 3000 feet. The piers which will extend from these solid-fill structures to the pier head line will be 3300 feet in width and 1100 feet in length. The sheds are planned to be of ample length so that the cargo of a vessel can be accommodated in the space behind its own berth. The Islais Creek channel, and the areas north and south of the channel extending from the waterfront into the bay will be dredged to a depth of at least 34 feet of water at low tide, in order to make this terminal accessible to ocean-going vessels. Ultimately the improvement will provide berths for forty-nine steamships each 500 feet in length, and six berths for vessels 300 feet in length.

GOVERNMENT WORK

Marine Railway—Specification 4254. The local navy yard at Pearl Harbor, H. T., received no bids November 17 for completing the marine railway.

Power House, Annapolis, Md.—The Navy Department, Bureau of Yards and Docks, Washington, D. C., is taking bids for a new power house at the Government plant.

Refrigerating Equipment, Brooklyn, N. Y.—Specification 4282, the Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to install refrigerating equipment in Building "F."

Electric Distribution System, Bar Harbor, Me.—Specification 4341, the Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to install an electric distribution system at the Naval Radio station.

Steel Hull—The United States Engineer, War Department, Washington, D. C., let contract for

furnishing a steel hull for the dredge Grossette, at New Orleans, to the Nashville Bridge Company, Nashville, Tenn.; \$23,400.

Quay Wall, Norfolk, Va.—Bureau of Yards and Docks, Navy Department, Washington, D. C., let contract for building a quay wall to H. P. Converse & Company, 31st Street & Colonial Ave., Norfolk. The work must be completed in 300 days, and will cost \$234,909.

Naval Experimental Research Plant, near Velleve, D. C.—The Navy Department, Washington, D. C., has awarded contract to the Boyle-Robertson Construction Company, Evans building, for a new naval experimental research plant to cost about \$652,700, including equipment.

Concrete Dock.—Lange & Bergstrom, of San Francisco, Cal., were awarded a contract by the Navy Department for the construction of a 600-foot concrete dock at the North Island Naval Air Station. The contract amounts to \$360,000, and work was started about December 15.

Dredging.—The United States Engineer Office, 329 Custom House building, New Orleans, La., will receive until 11 A. M., January 10, 1921, sealed proposals for dredging in the Intracoastal Waterway between Mermentau and Calcasieu Rivers, Louisiana. Further information on application.

Dredging and Wharf Construction, Norfolk, Va.—The United States Engineer Office, Norfolk, Va., will receive sealed proposals until 12 o'clock, noon, January 7, 1921, for dredging in the Elizabeth River and constructing a timber wharf partially surrounding the dredged area. Further information on application.

Transport to be Converted, Hoboken, N. J.—The United States army transport Wright, recently delivered by the Hog Island yard, is being converted at the Tietjen and Lang yard, into a mothership for seaplanes and balloons. A well is being located on the after deck, 100 feet long, 40 feet wide and 33 feet deep. An inflated balloon may be carried by the mothership, while just aft of the well will be stowing space for other equipment. The Wright will have a plant for making gas to inflate the balloons, and other unusual equipment.

Ships to be started are the West Prospect, 11,000 deadweight, by the Los Angeles Shipbuilding & Dry Dock Company; Chopaka, 11,000 deadweight, by the Los Angeles Shipbuilding & Dry Dock Company; Lubrico, 10,000, by the Moore Shipbuilding Company; Swiftstar, Swiftwind, Swiftagle, Swiftlight, Swiftking, 10,000 deadweight ton tankers, to be built by the Northwest Steel Company at Seattle, with the understanding that they will be purchased upon completion by the Swiftsure Oil Corporation of New York; Lio, 10,200 deadweight, to be built by the Baltimore Dry Dock & Shipbuilding Company.

Government Program.—Nine more keels are to be laid down for the Shipping Board before the Government's building programme will have come to an end. During the month of November five new vessels were started, four of which will be oil carriers. The keel was laid on the building berth for the 10,100 tanker Homer at the Alameda plant of the Bethlehem Shipbuilding Corporation. The Baltimore Dry Dock & Shipbuilding Company started the Tuslagus, 10,200 tons; the Los Angeles Shipbuilding & Dry Dock Company laid down the West Greylock, 11,000 tons; the Moore Shipbuilding Company started the West Tusten, 10,000 tons, and the Alameda yard of the Bethlehem Shipbuilding Corporation has entered upon the construction of a second 10,100-ton tanker.

Navy Contracts, Quincy, Mass.—It is announced by the Fore River plant of the Bethlehem Shipbuilding Corporation that the keel for the superdreadnaught Massachusetts will be laid soon after New Year's day. The vessel will have a length of 660 feet overall, 106 feet beam, and a displacement of 43,200 tons. She will have electric drive, engines of 60,000 horsepower, and a speed of 23 knots. The keel of the Lexington, a battle cruiser, will be laid soon after that of

the Massachusetts. She will have almost exactly the same beam as the Massachusetts, but her length overall is to be 880 feet and her displacement 43,500 tons. Her engines, of 180,000 horsepower, will yield a speed of 35 knots under electric drive. Two unnamed scout cruisers with 90,000 horsepower engines and a speed of 35 knots, also will be built at Fore River in the coming year. They will be 550 feet long with 55 feet beam and are each to carry eight 6-inch guns. Keels are also soon to be laid for six submarine boats each 225 feet long. The yard can lay down eighteen submarines at a time.

TRADE PUBLICATIONS

Ocean Engineer.—Number 1, Volume 2, of the Ocean Engineer, published monthly by the Ocean Marine Engineers Beneficial Association Number 80, at 15 Whitehall Street, New York; this booklet is issued by the engineers and is devoted entirely to their interests. It contains a large variety of articles and information of value to the deep water men.

New Calendar.—The Youngstown Sheet & Tube Company, Youngstown, Ohio, is issuing a 1921 calendar containing twelve two-color illustrations showing interesting processes in the manufacture of iron and steel.

Proper Stowage.—The proper stowage of export shipments is so important in successful export trade that the Bureau of Foreign and Domestic Commerce of the Department of Commerce has just published a special report on the subject, written by Thomas R. Taylor, who is now in charge of the Bureau's Latin-American Division. Its preparation was begun by Mr. Taylor while he was engaged with the Shipping Board, and it, therefore, contains data gathered through that service, and also some facts and figures compiled by the War Trade Board. Of direct interest to shipping concerns are chapters discussing the principles and methods of stowing, to secure maximum and volume, stowing to prevent damage or danger to the ship or crew, stowing to secure maximum speed and minimum cost, laws relating to the seaworthiness of vessels, and many other related subjects.

Dodge Catalogue.—The Dodge Sales and Engineering Company of Mishawaka, Ind., announces the publication of a catalogue on Dodge standardized elevators and conveyors. An interesting feature is the simple manner in which designs involving gearing are worked out, whereby almost any drive, whether for a conveyor, elevator or other speed reduction, can be picked out of tables; pitches, numbers of teeth and shaft sizes. All details are thus solved without any complicated calculations.

German Service Anniversary

The first anniversary of the American Line's passenger and freight service to Germany was reached during the voyage of the *Mongolia*, of that line, which sailed from New York for Hamburg on December 16. The first sailing in this service by which direct commercial intercourse with Germany was resumed after an interruption of more than five years was that of the *Manchuria*, December 20, 1919. Since then the two ships named and a fleet of American Line freighters have plied steadily to the German port.

Control of Government Ships

Secretary of the Navy Daniels has asked Congress for legislation authorizing the Navy Department to direct operation of all Government vessels in time of war and for six months thereafter.

MARINE SOCIETIES

AMERICA

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